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INSTRUCTIONAL PROGRAMMING PROCEDURES. A PROGRAMED COURSE IN THE BASIC METHODS AND TECHNIQUES OF PREPARING PROGRAMED INSTRUCTIONAL MATERIALS.

BY- DETERLINE, WILLIAM A.
DETERLINE, WILLIAM A., SAN ANTONIO, TEXAS
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A PROGRAMED COURSE IN METHODS AND TECHNIQUES OF PREPARING PROGRAMED INSTRUCTIONAL MATERIALS WAS PRESENTED IN THIS DOCUMENT. AN ATTEMPT WAS MADE TO TEACH BASIC PROCEDURES WELL ENOUGH TO PRODUCE AN EMBRYO PROGRAMER AND TO PROVIDE HIM WITH REFERENCES HE WOULD NEED IN ORDER TO PRODUCE PROGRAMS. INCLUDED WERE PROGRAMED INSTRUCTIONS ON PREPARATORY STEPS, WRITING THE ACTUAL TEACHING SEQUENCES, AND THE NECESSARY TEST-AND-REVISE PROCESS THAT FOLLOWS. RELATED DOCUMENTS ARE ED 003 815 AND ED 003 816. (ED)

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INSTRUCTIONAL PROGRAMMING PROCEDURES

A Programmed Course in the Basic Methods and Techniques of Preparing Programmed Instructional Materials

by

William A. Deterline

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APPENDIX

Errata Page

Page Number	Correction
7	response to frame 34, change "frame 32": should be "frames 29 - 32".
7	frame 37, line 2, "lerner" should be "learner".
12	response to frame 67, delete ".(Or words to that effect.)", and add ", in behavioral terms."
12	frame 69, delete asterisk after "program", add "consists of *".
32	question 4, "reponse" should be "response".
39	frame 37, delete dashes and insert "and" after "easy".
39	response to frame 40, add "relevant" before "response".
40	frame 48, line 2, "comcept" should be "concept".
65	frame 9, "amy" should be "may".
67	frame 18, line 2, insert "m" in "reme ber"; line 3, delete "so", add "in such a way".
74	frame 64, part 2), insert "d" in "grand addy".
78	question #3, "intoduced" should be "introduced".
79	answer #6, lines 3 and 5, "Tibetian" should be "Tibetan".
88	frame 32, last line, "mutliplication" should be "multiplication".
97	line 18, "responss" should be "response".
102	response to frame 1, change wording to read "Preparation of cue frame or copy frame."
124	frame 13, insert "a" after words "can consist of".
130	frame 44, line 2, change words "all the" to "any two".
130	frame 46, add to beginning of frame "Using RULEG terminology, ---".
132	to the left of frame 55 insert the response to frame 54: "54) 1836; 1836."
134	response to frame 67, add "two" before words "all of them".
140	needs additional space for answers.

Errata Page 2

Page Number	Corrections
159	response to frame 62, add parenthetical sentence: "(If you thought we meant "tell which is which", "discrimination" is a good answer.)"
160	frame 68, line 1, space needed between two words "long sequence".
161	response to frame 74, should be: "74) in the response form the student will need in the "real world"."
170	frame 11, fourth and fifth lines, insert words "verbal" and "from" so it reads "the verbal response of from one --".
205	frame 87, last sentence, delete "Before", should be "After", insert "criterion frame" before "objective".
205	frame 88, second from last line, after "one shown there." insert "They should be fairly similar."
214	frame 28, line 5, din't" should be "didn't".
230	response to 4, "ofr" should be "or".
237	frame 36, delete "The next series of editing steps" and add "The second part of the editing process is to".
238	response to 42, change to "Can you answer each one without difficulty?"
256	frame 25, line 4, insert "wrong" before the word "answer".
263	paragraph four, line 5, change "re-cycle" to "washback".
272	paragraph two, line 4, and paragraph five, line 6, "catagory" should be "category".

INTRODUCTION TO UNIT I
and to Instructional Programming Procedures

The primary objective of this programmed text is to teach you to write auto-instructional, or programmed, materials. This includes some important preparatory steps, writing the actual teaching sequences, and the necessary test-and-revise process that follows.

The techniques and procedures taught here have proved effective, but not all programmers follow the same rules. At this stage in the development of programmed instruction there is no one best way to write programs. As you read and study in the field, you will add other skills and approaches to these. For the present, you should learn this set of rules as if they were laws of nature. Later, in this program and with experience, you will learn how and where to make exceptions.

Most of the material in Chapter 1, Characteristics of Programmed Instruction, will be familiar to you. It will come as no surprise to most students of the method that a program consists of a series of small steps, called "frames", or that the answer to one frame is found in the next. When you go through Unit I you will encounter some frames that ask a question and give you a choice of answers, each answer referring you to a different frame. It is possible to look ahead without selecting an answer to one of those "branching" questions. It is also possible to skim the next few frames to find the correct answer frame without reading the frame that corrects any error you might have made. Please play the game every step of the way. You will learn more by doing so, and will have a better chance of finding out exactly how effective or ineffective each frame is as a teaching frame. Write every answer in this booklet. When you select an answer on a multiple choice frame that then offers you several frames to which you can go next, please put an "X" beside the answer of your choice.

One more request. Some of the frames in this program might cause you difficulty, perhaps because of ambiguity, or because you aren't sure what answer the program wants, or any one of a number of reasons. When you come to a frame of this sort, write the number of the frame on the inside of the first page of this book, with a comment or two about what you think is wrong with the frame. This kind of information will be invaluable when the program is revised to eliminate problem frames and problem sequences. Remember, put an "X" beside the choice you think is correct every time a multiple choice question is asked. If your choice sends you to another frame that indicates that you made an incorrect choice, be sure to read all of the information that tells why the choice was wrong, and be sure to follow the instructions that tell you to skip back or skip ahead in the program. OK? Go on to Unit I.

What is the function of this pre-test
It is too specific to serve as a general test of ones knowledge of programing — to much keyed to the author's format rather than to general knowledge.

PRE-TEST

UNIT I
CHAPTER ONE

The purpose of this pre-test is to determine what we call your "entering behavior". Please answer these questions before looking at Unit I. If you don't know the answer to a question leave it blank.

1. What is the special kind of lesson in this book called?

2. What do you call the method that uses this kind of lesson?

3. What is the purpose of such a lesson?

4. What characteristic of format or construction helps to accomplish this purpose?

5. A "D" average student is using a well written program:
   a) Does he make many or few errors?
   b) Does he go faster or slower or at the same rate as a "brighter" fellow student?

6. How does a student judge whether his answers are right or wrong? When does he find out?

7. How does the author of a program judge whether it accomplishes its purpose? What if it doesn't?

8. What does "adaptive sequencing" mean?

9. What is another name for the instructional goals of a program? In what terms are they always stated?

10. What per cent of the material described in these "goals" is it essential for the student to learn?

11. What do you call the characteristic of the method that lets the sequence of material adapt to the needs of the students?

12. Which of these are adequate statements of behavioral objectives?
    a) Student must understand the Pythagorean theorum.
    b) Student must list the 11 Confederate States.
    c) Student must be able to take the square root of a five digit number.
    d) He must be able to appreciate the influence of 8th century craftsmen on Western art.

UNIT I

CHAPTER ONE - CHARACTERISTICS OF PROGRAMMED INSTRUCTION

Chapter One describes the characteristics peculiar to programmed instruction which make it different from other teaching materials. "PI" makes learning easier as it breaks information down into small steps, provides opportunity for practice and adapts itself to meet different needs of students. Programmed materials are written to accomplish specific behavioral objectives, and are tested and revised until they do so.

1.
This book is a kind of teaching machine. Even though it's a book, we call it a teaching machine because it is going to teach you something. (When you see a blank, write the word that completes the sentence.) O.K., look below this frame at Frame 2 (Item 2)

+ I don't believe it is necessary to introduce the idea of teaching machines. GLCA instructors would react negatively to the implication that what teaches is a machine, and/or that machines teach.

1)
teach.

2.
See that word to the left? Teach is the word you wrote in the blank in Frame 1. Remember, we call this book a teaching machine. You are going to learn several things from this teach machine

2)
teaching; learn ;
teaching machine.

3.
This book-type * teaching machine contains a special kind of lesson called a program. We identify special training material of this sort by referring to it as a program.
(*______ means write more than one word.)

3)
teaching machine;
program.

4.
The special lesson in this book is called a program. Because this lesson is programmed, we call this kind of instruction, programmed instruction.

4)
program;
programmed
instruction.

5.
Instruction that uses a special kind of program is called teaching machine. Its only purpose is to help you learn.

5) programmed instruction; learn.	6. O.K. All you've learned so far, and maybe you knew it already, is that this book is a kind of *teaching machine and this lesson is called a program. The method is called *programmed instruction.
6) teaching machine; program; programmed instruction.	7. Montana, Idaho, South Dakota and Texas are four of our 50 states. This program was written in the Lone Star state; that is, it was written in Texas.
7) states; state; Texas.	8. Remember, when you see a blank, we want you to write the word or words tnat fit the blank. Got it? Let us brag once more This program was written in Texas.
8) program; Texas.	9. This book-type teaching machine contains a program that was *Texas (what and where).
9) program; written in Texas .	10. There, you learned something new! Not only that, you practiced the correct answers. To some extent it is true that practice makes perfect.
10) practice.	11. You're supposed to learn from a program. In this program we ask you to write each answer so you will learn it.
11) practice; learn (or remember).	12. Programmed instruction asks you to think of the correct answer, then practice it so you'll learn. Note that first you must think of the answer for yourself.
12) practice; learn; think.	13. The student using a program has to think of the answers himself.
13) think.	14. A program makes the student think of the answers, then practice them so he'll learn.

Transition needed here?

To call this learning and imply to ~~[illegible]~~ it is worth practicing being verges on insulting

This is not strictly true. Each answer is not practiced, but it is written.

This illustrates the problem of redundancy. X

The author says that practice is what caused the learner to remember Texas and lack of practice that caused learner to forget the other three states. How about such associations as Lone Star, ~~brag~~ "brag" to say nothing of the concentration of attention. ~~I feel~~

~~I feel tricked — like when you ask a person to [illegible] directions~~

How about trying to drop out frames 7 & 8 and seeing if the trainee gets frame 16 right

14)
think; practice;
learn.

15.
In fact, basic characteristic of the program you are reading now is that it asks you to * think of the answer.

15)
think of the
answers, then
practice them so
you'll remember.
(or words that
mean the same)

16.
Let's see if we are correct about the importance of practice! You did practice this one: this program was written in the State of Texas. (You practiced that, so you should remember it!)

What has practice to do with my remembering "Texas"?

16)
Texas .

17.
When we first mentioned Texas, we also mentioned three other states. What were they? ?, ?, and ?. (If you can't remember, go to the next frame anyway.)

17)
If you are not
sure, you may look
back at Frame 7.

18.
Nine out of ten people don't remember all three because they didn't write. those names. You did remember Texas because * ~~practice~~!.

How can the author be sure it was the practice of writing Texas 3 times or the simple writing it the first time?

18)
practice; I did
practice that word.
(or words that
mean the same thing)

19.
Just for fun, take a look at these blanks! (The program is going to try to lead you to a wrong answer.) This program was written in Texas. The Declaration of Independence was also * ?

What's the purpose of this frame?

19)
Texas; "written in
Texas" is the answer
suggested, but you
know that isn"t
true.

20.
Let's summarize: A program is designed to * think of the answers.

20)
make the student
think of the answers
then practice them
so he'll learn
(remember), etc.

21.
You have already learned a couple of new things, and it wasn't at all difficult. In fact, this program was designed to make it all quite simple.

Does simplicity reside in the program technique or in the simpler material this program presents

21)
easy (simple).

22.
If we bombard the trainee with too much information at once, he won't be able to learn it. For this reason we break the information down into a series of small steps. Each of these frames is one ? ? designed so that learning will be simple.

Try as I may I can't think of the answers

This is generally true. But you could pour on quite a bit of that Texas stuff without drowning the trainee

How was learner supposed to think of this answer?

22)
small step; easy.

23.
A program guides the trainee through a series of * small steps. In this way we make a difficult subject easy for him.

I'm really bothered by the author implying that ~~[illegible]~~ the subject matter presented so far is difficult. It still must be demonstrated that difficult subj matter will be made easy.

23)
small steps; easy.

24.
A student or trainee can learn new material if we present it to him in * small steps, thereby making it * easy for him.

24)
small steps;
easy to learn.

25.
In a program we always want the learner to be right. We want him to practice the correct answers, and we never want him to * make a mistake.

25)
right; practice
the wrong answers.

26.
~~A learner needs to be helped.~~ A program provides this help so that the student will always * practice the right answers

! !

26)
help; practice
the right answers.

27.
When a student is learning, he initially needs a lot of help. As he learns he should need less and less help until finally he * succeeds.

27)
help; needs no
more help (knows
all the answers).

28.
A student needs a lot of help early (early/late) in a program, but as he learns more and more, he * needs less and less

28)
early; needs
less and less help
(doesn't need as
much help).

29.
A program is a series of * ~~blanks~~ oops! that make learning easy by giving the student a lot of help so that he will always be able to * make right answers.

29)
small steps;
easy; help;
practice the
right answer.

30.
A student should never be left in doubt about the correctness of his answer, so each frame of a program immediately tells the student whether he was right or wrong. In a good program, most of his answers will be right.

30)
right or wrong;
right (you might
have said "whether
he was correct or
not". That's fine,
just so you express
the main idea.

31.
Each step requires the student to * think respond, and then immediately tells the student * if he is right.

31) think of an answer (answer, answer the frame); whether he's right or wrong.	32. A learner should never be in doubt as he tries to learn. An important feature of a program is the fact that the student always knows* if he is right.
32) whether he's right or wrong.	33. You see, it's not just important that the student practice the right answer, but that he know whether or not* he is right.
33) correct, his answer is correct.	34. Now in your own words, tell everything you have learned about programs. practice think right-wrong simple
34) Look at frame 29-32 for any clues you need to check the answer to this item.	35. A program is like a private tutor that adjusts to the speed of the learner. This is necessary because not all students * read at same rate, think as fast. Does a program adjust anymore than does a textbook
35) learn at the same rate (learn as fast as others).	36. A program does not move too fast or too slow for any student. A slow learner can take a lot of time if necessary, but he won't hold back any of the* fast learner. This is not so. True, the slow learner will not hold anyone back, but the program may.
36) fast; slow; time; fast learners.	37. A fast learner can go as fast as he wants, and a slow lerner can* ~~slow~~ go as slow as he wants.
37) fast; go as slow as he needs(wants).	38. A lot of care goes into the preparation of a program because we have to test it thoroughly to be sure that it teaches. We discover where a program is weak when we test it. Then the program must be revised to eliminate the inadequacies.
38) test; revised (changed).	39. Before a program is considered to be ready for use, it must be thoroughly tested and revised. Dozens, or even hundreds of people may be used in the process of* constructing it.

39)
tested and revised;
testing and revising
a program.

40.
So far you've read every frame. Now you'll have a chance to skip items unless you make mistakes. We call this "adaptive sequencing", because the program adapts to the needs of each student. If you think this means that every student takes a different route through the program, go on to frame 41. If you think it means that the route is determined by his answers, go to frame 42.

41.
(You came here from frame 40.)
You think that adaptive sequencing means each student takes a different route. No, that's not correct. Their routes depend on their needs, and could be the same. Suppose two students make the same error on a frame; should they be sent to the same, or to different correction frames?

Same - go to frame 43.
Different - go to frame 44.

42..
(You came here from frame 40.)
His answers determine his route. Right! The program must adapt itself to the student. If you had made an error on that first frame, you would have been sent to a remedial sequence designed to correct the error. If you were right the first time, turn now to frame 41 and follow the remedial sequence. If you've already been through it, go to frame 45.

43.
(You came here from frame 41.)
You chose "same correction item". That's right. One student may need more help than another, but when two students make identical errors, the immediate correction will be the same for both. Now go back to frame 40 and answer that question correctly.

44.
(You came here from frame 41.)
You chose "different correction items". You're wrong! The immediate correction will be the same for two students who make identical errors. One student may need more help than another, but they both go first to the same correction frame. Got the idea now? Return to frame 40 where

you made an error, and this time answer the question correctly.

45.
(You came here from frame 42.)
See how one kind of adaptive sequencing works? Try this review. When adaptive sequencing is used:

Each student goes at his own rate,
  determines his own sequence---frame 46.
Each student takes a different route,
  but all take the same amount of
  time--------------------------frame 47.
Each student takes every item, but
  determines his own sequence-frame 48.

46.
(You came here from frame 45.)
Your choice was "his own rate and own sequence". Right! Now, adaptive sequencing is not always necessary, and sometimes different types of adaptive sequencing are used. In frame 33 you were asked a difficult question. If you were not sure of the answer, you were asked to go back and use part of the program a second time. Now go on to frame 49.

Is this correct? or should it be 43?

47.
(You came here from frame 45.)
Different routes, same amount of time. Not true. Times will differ depending on how many items he needs, and the speed with which he goes through them. Now go back to frame 45 and choose the correct answer.

48.
(You came here from frame 45.)
You said every student takes every item, but determines his own sequence. No, not when we use adaptive sequencing. If a student makes no errors at all, he doesn't see any of the remedial frames. Why should he? Now go back to frame 45 and answer it correctly.

49.
(You came here from frame 46.)
There are many kinds of adaptive sequencing, all designed to make programs more flexible. The characteristic of programs that lets the sequence adapt itself to the needs of the student is called adaptive sequencing.

49) adaptive sequencing.	50. When a program allows the student to follow a sequence that is in part determined by his needs, we say that the program includes a feature called * a – s —, in which the sequence a itself to his ~~of~~ needs
50) adaptive sequencing; adapts; needs.	51. Adaptive sequencing includes techniques called branching, bypass, recycle and others. All of these have the same purpose; to a – the s — of items so that it will meet the* need of student.
51) adapt; sequence; needs of the student.	52. We're not ~~done~~ finished yet. We haven't talked about the objectives, or goals, of a program. Another name for the instructional goals is the word" obj ".
52) objectives.	53. Before we can write a program, we have to determine its goals or obj. We can't teach unless we know what to teach! Is "what to teach" an objective?
53) objectives; what.	54. A statement of behavioral objectives tells us what to teach by telling us what the student must do.
54) what; what.	55. What must a student do, in terms of observable behavior? "He must understand the Pythagorean theorem". Does that statement specify what he must do? Yes - turn to frame 56. [✓ No] - turn to frame 57.
	56. (You came here from frame 55.) You think that "Understand" does specify what he must do. No, it does not, not well enough for us to teach or write a program. Look at it this way; does the statement "understand the theorem" tell us what answers he should practice or what questions we should ask, or what help we should give? Go back to frame 55 and choose the other answer.
	57. (You came here from frame 55.) No, it does not specify what he must do, and you are correct. A clear statement of objectives tells us what he must practice.

Now try this one. "Must correctly compute square roots, showing all computations."

Specific objective - frame 58.
Too vague - frame 59.

58.
(You came here from frame 57.)
You said it was a specific objective. You're right. We know exactly what to teach, and what the student must do. A good statement of objectives doesn't use words like "know", "understand", "appreciate", or "really understand". How about this? "The student must grasp the principle of cancellation."

Adequate - frame 60.
Inadequate - frame 61.

59.
(You came here from frame 57.)
You don't like the statement "compute square roots, showing all computations". You chose the wrong answer. The statement tells us what the student must do, and the behavior is observable. Go back and answer frame 57 again, this time making the correct choice.

60.
(You came here from frame 58.)
You approved of "grasp the principle". You're wrong this time. This statement does not refer to observable behavior. Go back to frame 55 and start there again.

61.
(You came here from frame 58.)
You say "grasp the principle" is inadequate, and you're right! This is not a statement that refers to observable behavior, is it? It would be adequate if it said "state the principle and give examples". Go on to frame 62.

62.
Before we can teach, we must determine the behavioral objectives of the lesson. The first step in preparing a program is always the determination of the*_______________ _______________.

62)
objectives;
behavioral
objectives.

63.
"The student should be able to use a logarithm table correctly, and carry out the operations of multiplication and division using logs." This statement

	specifies the* b— o — of the lesson, which means the objective is stated in terms of observable ____.
63) behavioral objectives; behavior.	64. A behavioral objective describes what the student must be able to do, always stated in terms of * behavior.
64) do (learn); observable behavior.	65. Each behavioral objective, which describes what a student must do, is an essential outcome of the lesson. Most books contain a lot of material which is not essential.
65) do (learn); essential.	66. A program shouldn't contain a lot of unimportant material. We want the student to practice only those responses that are important.
66) essential (important).	67. An adequate statement of a behavioral objective always indicates * what S - must do.
67) The essential responses the student will be able to make. (Or words to that effect.)	68. You've learned that the most important characteristic of a program is that it consists of a series of* small steps that are designed to help you to * ?.
68) small steps; practice the right answers (or learn the right answers, or some equivalent statement).	69. Practice that last reponse once more. A program * ~~co~~ consists of a series of small steps designed to help me practice right answers.
69) (check the answer to the last frame.)	70. A passive student rarely learns, so the program attempts to keep him active. Every time he reads a frame he must * respond.
70) active (busy); answer a question (or make a respnse, or keep active).	71. After the student answers each question, the program promptly * confirms.

71) tells him whether he's right or wrong. (or tells him if he's correct).	72. Each student may proceed through the program * at his own pace.
72) at his own rate. (as fast or slow as he likes).	73. Adaptive sequencing means * fitting the ~~responses to the~~ program to responses. of student
73) (Your answer should indicate that the sequence adapts to the needs of the student, or that the student takes the route through the program best for him, etc.)	74. A statement of the goals of a program is called a statement of obj. A statement of what the student should "understand" ________ [✓ is]/isn't) adequate.
74) objectives; isn't.	75. A program makes it easy for the student to learn without making too many errors.
75) easy; learn; mistakes.	76. There are other aspects of programmed instruction, but you have already learned most of them. Here's an unimportant point: some people spell programmed with only one M, while others use ________.
76) two (MM).	77. OK, go on to the discussion.

I still say this isn't a good expectation to raise!

To what extent does this program merely teach verbal chaining rather than association of ideas?

DISCUSSION FOLLOWING CHAPTER ONE:

Probably many of the characteristics described in that short program were already familiar. From here on you will encounter new ideas and some of the techniques used to prepare instructional materials. Although these materials are strikingly different from conventional teaching methods in appearance, function and even student involvement, this method of training is not a mysterious new philosophy of education. We are still dealing with the basic human learning processes that have been essential to every instructional situation since the first cave man tried to teach another of his species.

Then there is nothing new about programming, right? Wrong! Educators have known for years that instruction should be in small steps, require active responses and immediately tell whether the answer is right or wrong. But there is a tremendous difference between saying that these things are necessary and being able to guarantee that they occur! An instructor may think his presentation is in small steps, but leave his students hopelessly lost. The characteristic of programmed instruction that makes it revolutionary is the reliable control exercised over the process of learning.

A program is written according to certain principles of learning, but this is only the beginning. A program, unlike a lesson plan, textbook or lecture, does not reflect only the intuition and insight of its author, but also reflects the performance of many tryout students. After we write a program, revise it, and edit it until it looks good, we don't stop there. It must be tried out on students, and every frame which does not do its teaching job must be changed. In a finished program inefficiency is removed to give the student well controlled, systematic instruction.

So while programmed learning does not deal with any startling new principles of learning, it does deal with a new way to apply principles, and to provide control over the learning process. Many of the principles have been known for years, but now we have a way of systematically applying them to maximize the effectiveness of instruction.

As you go through this program, you will find that you never read anything without practicing what you learned, or should have learned, from the material you read. When you come to a question, try to answer in your own words. Then check back into the reading material to see if your answer is adequate. If it is not, revise it until it is adequate and then write it down. Always write the answer when you are asked a question in this program.

Now here's your first question:

According to this programmer, in his views expressed above, what is the most important aspect of programmed instruction?

You probably realize that after you answer a question, you will be told either what you should have answered, or where to find the correct answer. In this case, you should have said that the big new thing about programmed instruction is the way it allows us to apply principles of learning, thus gaining control over the learning process to an extent that was impossible in the past.

POST-TEST CHAPTER ONE

Yes, they are the same questions! See if you do any better.

1. What is the special kind of lesson in this book called? program

2. What do you call the method that uses this kind of lesson? programed instruction

3. What is the purpose of such a lesson? ~~text~~ think of the answer

4. What characteristic of format or contruction helps to accomplish this purpose? ~~practice the~~ answers small easy steps

5. A "D" average student is using a well written program:
   a) Does he make many or few errors? ?
   b) Does he go faster or slower or at the same rate as a brighter buddy? slower

6. How does a student judge whether his answers are right or wrong? When does he find out? next frame

7. How does the author of a program judge whether it accomplishes its purpose? What if it doesn't? criterion test revise

8. What does "adaptive sequencing" mean? sending student to frames in terms of how he responds

9. What is another name for the instructional goals of a program? In what terms are they always stated? obj behaviors

10. What per cent of the material described in these "goals" is it essential for the student to learn? This question is not answered in this program

11. What do you call the characteristic of the method that lets the sequence of material adapt to the needs of the students? adaptive sequency

12. Which of these are adequate statements of behavioral objectives?
   no a) Student must understand the Pythagorean theorem.
   ok b) Student must list the 11 Confederate States.
   ok c) Student must be able to take the square root of a five digit number.
   d) He must be able to appreciate the influence of 8th century Nordic craftsmen of Western art. no

ANSWERS TO POST-TEST ON CHAPTER ONE

To check your answers, and you should check every one of which you are not completely certain, refer to the indicated frame or frame sequence.

QUESTION	FRAMES
1.	3
2.	4 - 5
3.	5, 14, 20
4.	22 - 24
5.	25, 36, 37
6.	30 - 31
7.	38 - 39
8.	40 - 51
9.	62 - 65
10.	65 - 67
11.	40 - 51
12.	62 - 65

no correct answer found herein

PRE-TEST

CHAPTER TWO

Please answer these questions before looking at Chapter Two.

1. What two elements are necessary parts of every frame? info, response

2. a) Name four different kinds of frames.
   b) Describe the essential characteristics of each.

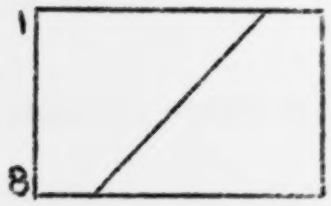
3. What kind of frame(s)........
   a) must follow an information frame?
   b) should be used to introduce an unfamiliar new word?
   c) will never permit a student to copy the response?
   d) can be called an information frame?
   e) will require a complete answer?
   f) can use an old association to build a new association?
   g) should be used to introduce a familiar word?
   h) may be used if there is no existing association?

4. What sequence design do you use when.....
   a) the response is already part of the student's vocabulary?
   b) the response is not in his vocabulary?

5. An information frame does what two things?

6. Under what conditions do you use......
   a) a cue frame to begin a sequence?
   b) a copy frame to begin a sequence?

7.



This diagram represents the eight frames in a complete sequence.

   a) What kind of frame is frame 1?
   b) What kind of frame is frame 8?
   c) From the information illustrated in the diagram, tell whether it is a good or poor program, and why.

What if I answered all these correctly? Could I skip chapt 2? How would I know if I were correct?

UNIT I.
CHAPTER TWO

Before you begin writing frames, you must know the characteristics and purposes of the basic types of frames. You will also learn some characteristics of a good frame sequence, after which we'll discuss the various terms used by different programmers.

	1. Each frame includes at least one stimulus and at least one response. It is obvious that the information given you is a kind of stimulus, and your words or answer is a kind of __________.
1) response.	2. The program provides the stimulus, and you provide the __________. Every frame includes both a __________ and a __________. (Be sure to check this answer.)
2) response; stimulus; response. (Just to keep the program honest, there is a type of frame called a lecture or discussion frame that does not require a response other than reading the frame.)	3. The student responds when the program provides an appropriate __________. We'll consider first how a student is taught an unfamiliar new word. The student must learn the new word as a response to a __________.
3) stimulus; stimulus.	4. The first time a student uses an unfamiliar new word, we let him copy it. A frame in which he copies a word is appropriately called a copy frame.
4) copy. (or copying)	5. We introduce an unfamiliar new word by letting the student _____ the word in a _____ frame. The rule is: An unfamiliar new word is always introduced by using a frame called a *____________________.

5) copy; copy; copy frame.	6. After a student has copied the word, we want him to practice it in the next frame. For this reason, the frame that follows a *________________is always a frame called a ____________ ____________.
6) copy frame; practice frame.	7. A student cannot copy the response in a *______________________. The sequence begins with a * copy________ followed by a * practice________________.
7) practice frame; copy frame; practice frame.	8. The general rule for introducing an unfamiliar new word is: *______________ ____ ______________________________________.
8) copy frame followed by a practice frame. (or, let him copy the word first, then have him practice it without copying it, etc.)	9. This first procedural rule involves the "Copy-Practice" design. The second design uses what we call a "cue" frame instead of a copy frame, so this second design is called the "cue - practi" design.
9) cue-practice.	10. When the desired response is not already part of the student's repertoire, we use the first design, the *________________ design; and when the response is part of his present repertoire, we use the second design, the *______________________design.
10) copy-practice; cue-practice.	11. An unfamiliar word, like "klystron" would be introduced using the design we call the *________________________________. A well-known word, like "more", "North", or "battery" could be introduced using the *______________________________________.
11) copy-practice design; cue-practice design.	12. The rule is: An unfamiliar word is introduced in a _____frame, while a very ________ word could be introduced in a *______________.
12) copy; familiar; cue frame.	13. In a copy frame the student is permitted to______the appropriate response, but in a practice or cue frame, the student *____ ______________________________.

13) copy; cannot copy the response. (Any similar meaning will do.)	14. You have seen how an unfamiliar word is introduced in a _____frame. Now you need to know more about introducing a familiar word in a *________________________.
14) copy; cue frame.	15. Suppose the response is to be "upgrade" in the sense of "promotion". We'll rely on certain available associations: When we demote an employee and reduce his job level, we downgrade him; when we promote him to a higher level, we upgrade him.
15) upgrade.	16. Down is the opposite of up, and demote is the " of promote. There are many examples of this type of existing association: up and ______; in and _____; hot and _____; before and _________.
16) opposite; opposite; down; out; cold; after.	17. Another example of the same type of existing association: Tom can have either _____ money than Jack, ________money than Jack, or the _________amount of money as Jack.
17) more; less; (either order) same.	18. A cue frame uses an existing association. A copy frame is used when there is *_____ ____________________________________. Hot and __?__ is an example of an *________________________________and could be used in a ______frame to produce the response word"_________".
18) no existing association; existing association; cue; cold.	19. When calling for a word for the first time in a program, use either a cue frame or a copy frame. Use a cue frame when there is an *__________________________; and use a copy frame when *____________ ____________________________________.
19) existing association; there is no existing association.	20. There are many ways to cue a response. Language habit associations, such as those you saw in frames 15, 16, and 17 are one type of *____________________________ that can be used to _________a response in a *______________________.

20) existing association; cue; cue frame.	21. Remember, we ______a response by using an *__________________________. When this is not possible, we introduce a new word by using a _________frame.
21) cue; existing association; copy.	22. Cue frames and copy frames could be called information frames, because they give new __________to the student. A practice frame, however, could never be called an _________________frame.
22) information; information.	23. We have discussed only three basic types of frames: cue, copy and practice. We're just going to refer to cue and copy frames (and some others we haven't talked about yet) as __________frames, because they provide new _____ ______________.
23) information; information.	24. In order to have the student use new information, the program must first ________ information to the student. Every information frame must first _______ ___________ to the student, then *__________________ ______________________________________.
24) give (present); give information; have the student use the information (teach the student to use the information.)	25. Every information frame in a program must do two things: (1) *__________________________________. (2) *__________________________________.
25) give the student information; have the student use the information.	26. To give information, a word must have meaning, that is, form associations. If the word "gazorenplatt" has no associations for the student, then the word has no _________to him. If we build an association for that word, it will then *______________________.
26) meaning; have meaning. (give information)	27. Try this: A Neon Tetra, like a tuna, trout and bass, is a kind of ______. The existing association is between the words tuna, trout and bass, and the familiar word, "_______". The new association is between the new name, "*______________", and the old familiar word "__________".

27) fish; fish; Neon Tetra; fish.	28. The unfamiliar name, "Neon Tetra" probably had no previous associations with anything for most people, but now it has become associated with the word "__________". Was the association taught in a copy frame or cue frame? * __________________________.
28) fish; cue frame. (Remember the student couldn't copy the word "fish", could he?)	29. The cue frame helped the student state that a Neon Tetra is a kind of fish. We used an *______________________to build a *___________________________.
29) existing association; new association.	30. When we teach, whether in a program, a lecture, or a textbook, we build *_____ ___________________ that are based on *___________________________________.
30) new associations; old associations.	31. Let's go further with the Neon Tetra sequence. After the cue frame we must give the student a __________frame. Since the response in the cue frame was "________", the response in the ____________ frame must also be "________".
31) practice; fish; practice; fish.	32. In the practice frame the student will practice the word "fish", but let's use the same frame as a cue frame for a new idea! A Neon Tetra, like a tuna, is a _________, but while a tuna is very large, a Neon Tetra is a very _________ _________.
32) fish; small fish.	33. In that practice frame the student practiced the word "_______". The frame was also a cue frame that used the concept of opposites (large and small) to cue a new association; the fact that a Neon Tetra is a very _______ _______.
33) fish; small fish.	34. In the next frame the student must practice the word we just cued (small), and we'll cue one more item of information. A Neon Tetra is a *______________ found in the largest river in South America. You could catch Neon Tetras in the ______________River.

34) small fish; Amazon. (We assume you know that the Amazon is the largest river in South America.)	35. The next frame provides further practice, with less help: A Neon Tetra is a *____________ that lives in the *____________. By using the word"also", we can add one brand new association: A Head and Taillight Tetra is also a *________________________.
35) small fish; Amazon River; small fish that lives in the Amazon River.	36. Now we can have the student give a summary without any help from the program at all: Tell everything you know about NeonTetras and Head and Taillight Tetras. *________________________.
36) They are small fishes that live in the Amazon River.	37. The sequence was built on three existing associations: (1) tuna, trout and bass are all _______; (2) (opposites) while tuna is large, Neon Tetra is _______; (3) the largest river in South America is the *________________.
37) fish; small; Amazon River.	38. The stimulus "Neon Tetra" was first associated with *________________ and *________________. A new stimulus, Head and Taillight Tetra was then paired with *____________and *________________.
38) small fish; Amazon River; small fish; Amazon River.	39. Three existing associations were used to teach the student some new associations. He practiced stating the new associations; that Neon Tetras and Head and Taillight Tetras are *________________________.
39) (Few students would have to look at this space to see if the answer was correct, so we won't bother to print it here.)	40. Let's change the subject now. Some frames require the student to respond with only one word, while other frames call for _______than_______word. An asterisk (*), for example, calls for *________________________.
40) more; one; more than one word.	41. Which is more like a real-life question and answer situation: responding with one word, or giving a complete answer? *________________________.

41)
giving a complete answer.

42.
A program does not adequately teach if the student does not progress past the point of giving only *_________________________. Eventually in the program the student must learn to produce *____________________________________.

42)
one word answers;
a complete answer.

43.
A cue or copy frame might require only a one-word response, but a criterion frame asks the student to produce a *______________________________. Cue and copy frames are information frames, but practice and _______________frames are not.

43)
complete answer;
criterion.

44.
A frame that asks the student to produce a complete statement, answer, manipulation or solution, is called a __________ frame.

44)
criterion.

45.
Frame 8 said: "The general rule for introducing unfamiliar new words is *blank ." That frame was an example of a *_____________________because it *____.

45)
criterion frame;
requires a complete answer.

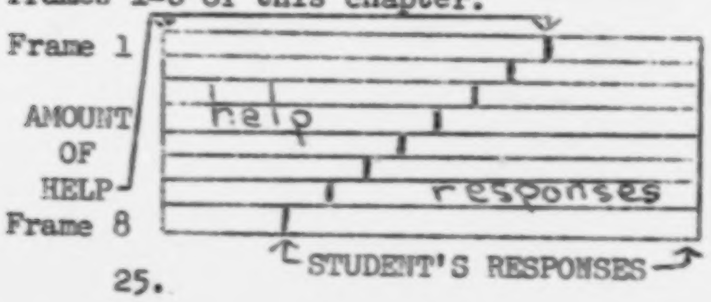
46.
The preceding frame and this one are examples of criterion frames because *___________________________________.

46)
they require complete answers. (Or any equivalent answer.)

47.
Frame 1 began the sequence, and frame 8 was the first criterion frame in this chapter. Which of those two frames required more extensive responses and gave little help in that frame? ________. And which of those two frames called for a very small response and gave lots of assistance?________.

47)
8; 1.

48.
This diagram represents the sequence of frames 1-8 of this chapter.



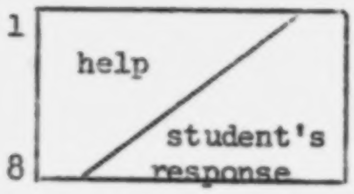
The diagram shows that as the student works through the sequence, the amount of help offered by the program ________ (increases or decreases) while the length of the student's response __________ (increases or decreases).

48)
decreases;
increases.

49.
A program should proceed in small steps, steadily building the student's capability. For this reason, during the sequence the help offered by the program ___________ in amount as the length and complexity of the student's response ________________.

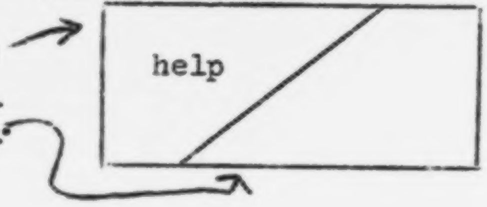
49)
decreases;
increases.

50.
On the left of the diagonal we represent the amount of guidance and assistance. On the right you see that the amount and complexity of *____________________ should steadily__________.



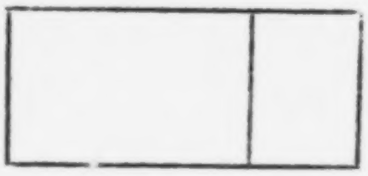
50)
the student's
response;
increase.

51.
In this diagram of a good program, the amount of __________decreases as the *__________ ____________________.



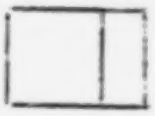
51)
help; length of
student's responses
increases.

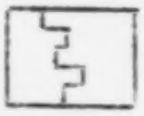
52.
This is a diagram of a poor sequence. What is wrong with it? *_______ ______________________ ______________________ ______________________.



52)
The amount of help doesn't decrease and the student's response never increases. (Student never makes a complete statement).

53.
When the student completes the program he should be capable of complete and complex responses. Which of these is the only adequate sequence? __________.


A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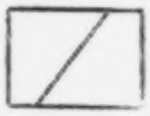
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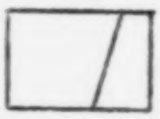
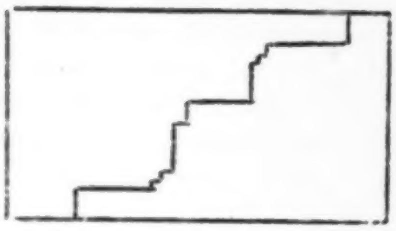

D

53)
c.

54.
A program should proceed in steps that are neither too large nor too small. What kind of error is represented by the sequence shown here?
* ____________
____
____
____________.



54)
Some of the steps are too large and some too small.

55.
Now let's review. So far we've discussed the square that represents student development, and earlier we discussed two frame-sequence designs, which were:
(1) * ____________________.
(2)* ____________________.

55)
copy-practice design;
cue-practice design.

56.
An information frame does two things:
(1) * ____________________.
(2) * ____________________.

56)
gives information to the student; has the student use the information.

57.
You have learned the names of two kinds of information frames, which are: * ____________ and * ____________.
You have also learned about two kinds of frames which are not information frames. They are * ____________ and
* ____________.

57)
copy frames; cue frames; (either order); practice frames; criterion frames. (either order).

58.
A sequence must begin with either a ________ frame or a ________ frame, followed immediately by a ________ frame, and then proceed gradually toward a * ____________.

58)
cue; copy;
practice;
criterion frame.

59.
You saw in the Neon Tetra sequence some of the ways that we can write cue frames to build * ____________ based on * ____________.

59)
new associations;
old associations.

Go on to the discussion about terms.

DISCUSSION: FOLLOWING CHAPTER TWO.

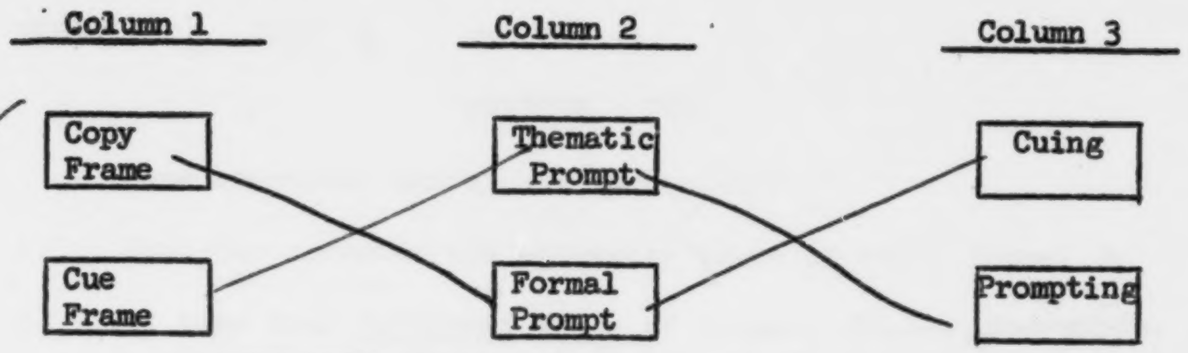
Let's look at the words, "cue" and "copy", as used in this program, and at related terms that appear in various literature of programming. First it must be emphasized that there is no controversy here. The only justification for the use of any terminology of this sort is its value as a means of communication with other programmers and its potential use to you, the student.

As we use them, "cue" and "copy" refer to methods by which we help the student produce a response. A different terminology uses the word "prompt" to refer to all methods of eliciting a response. Among the various kinds of prompts in this framework are the "formal prompt" and the "thematic prompt". A copy frame would fit the definition of a formal prompt. That catagory would also include such devices as giving the student several letters of the word he is to copy or produce from an existing association, and making a blank into a set of dashes, each dash representing one letter of the word to be produced. The thematic prompt is very close to what we have called a "cue frame", in that it makes use of existing associations.

There is another classification system that sets up two kinds of techniques, one called "cuing" and the other called "prompting". In this context a prompting frame is like our copy frame, and a cuing frame about the same as our cue frame.

As you read books and articles in the field of programmed instruction, you can pick and choose among the terms that appear useful to you. If you prefer to use the terms "formal prompt" and "thematic prompt" rather than "copy frame" and "cue frame". that should be your choice. (Note: By any name, the technique of providing some of the letters of a word, or dashes to indicate the number of letters in a word, is obsolete. This technique has just about disappeared because it has not paid its way.)

There is only one question for you to answer now. On the next page you will find three columns representing three slighty different terminologies mentioned above. Column 1 has in it our "cue frame" and "copy frame" labels. Match the similar terms in each column. Draw a line from the box in column 1 to the box containing the similar term in column 2,and then extend the line on to the other similar term in column 3. Simple, isn't it?


Column 1
Column 2
Column 3
Copy Frame
Cue Frame
Thematic Prompt
Formal Prompt
Cuing
Prompting

In this case we won't show you the correct answer. Check back into the text to be sure that you have the relationship correct.

Now, in chapter 3, you will learn a little bit more about the stimulus and response contents of frames.

These can be answered from p28

POST-TEST UNIT I

CHAPTER TWO

Same questions again, but much easier.

1. What two elements are necessary parts of every frame?

2. a) Name four different kinds of frames. Cuing, ~~prompting~~ copy practice
   b) Describe the essential characteristics of each.

3. What kind of frame(s).........
   a) must follow an information frame? practice
   b) should be used to introduce an unfamiliar new word? copy
   c) will never permit a student to copy the response? practice
   d) can be called an information frame? cue + copy
   e) will require a complete answer?
   f) can use an old association to build a new association?
   g) should be used to introduce a familiar word? cue
   h) may be used if there is no existing association? copy

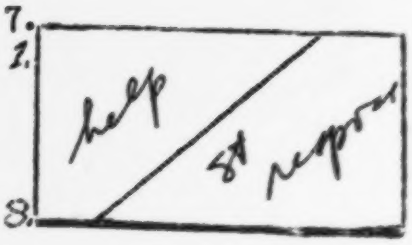
4. What sequence design do you use when......
   a) the reponse is already part of the student's vocabulary? ~~copy~~ cue practice
   b) the reponse is not in his vocabulary? [illegible] copy - practice

5. An information frame does what two things? ~~inform & resp~~

6. Under what conditions do you use...
   a) a cue frame to begin a sequence?
   b) a copy frame to begin a sequence?

copy - practice
cue - practice

good! question!

7.


This diagram represents the eight frames in a complete sequence.

a) What kind of frame is frame 1? copy-cue
b) What kind of frame is frame 8?
c) From the information illustrated in the diagram, tell whether it is a good or poor program, and why. good

ANSWERS TO POST-TEST ON CHAPTER TWO

Question	Frame
1.	1 - 2
2.	57
3. a)	58
b)	5 - 6
c)	7
d)	22
e)	43
f)	10 - 12
g)	10 - 12
h)	10 - 12
4. a)	10 - 12
b)	10 - 12
5.	24
6. a)	10 - 12
b)	10 - 12
7. a)	48, 58
b)	48, 58
c)	51 - 53

PRE - TEST UNIT I.

CHAPTER THREE

1. What are the two critical characteristics of every frame?

2. a) The words, terms or phrases of a response may be divided into what two classifications?
   b) What is the basic difference between these two classifications?

3. Which of these frames have adequate stimulus content? (If they were to appear at this point in this program.)

   a) A criterion frame is *____________________.
   b) A program *____________________.
   c) A practice frame never *____________________.
   d) Every frame contains both * info + response.
   e) You use a copy frame when *____________________.

4. Which terms in this reponse are specific?

   On the exhaust stroke the exhaust valve opens and the burned gasses are forced out through the exhaust valve by the returning piston. ____________________.

5. a) By what design do you teach specific terms?
   b) How do you teach general terms?

6. If you are not sure whether a term is specific or general, how should you teach it?

7. Define "stimulus" as it applies to the content of frames.

8. Define "response" as it applies to the content of frames.

9. Why do we say you should first decide what the response should be for a frame, then write the frame?

UNIT 1

CHAPTER THREE

In this chapter we'll talk some more about the stimulus and response characteristics of frames, and specific and general terms in a response. You'll learn something about writing frames to teach specific responses. You may be suprised to find what comes first in writing frames and, indeed, programs.

1.
Let's look at some of the ways you might write a copy frame. Suppose "1776" is the desired response, and we wrote a copy frame like this:

Copy 1776 here: 1776.

Could the student make the required response? yes

1)
1776; yes.

2.
Yes, of course he could copy 1776 if we told him to, but did we associate this response with any particular stimulus? no

2)
No. (We did associate it with the stimulus words "Copy it", but that isn't a useful association, is it?)

3.
2 x 888 = 1776; 2000 - 224 = 1776.
The response "1776" can go with the stimulus "2 x 888 = ?", or "2000 - 224 = ?", and you can easily think of another stimulus that we might want to associate with this response in a history program for young children. See, a response by itself has little meaning; it must be associated with a specific stimulus.

3)
stimulus.

4.
If the program tells you to copy the word "koboshen" 50 times, has the program taught you anything meaningful? No. Why or why not?* not associated with specific stimulus.

4)
No. Because the word has not been associated with anything else. It is neither a stimulus nor a response to you.

5.
A criterion frame always provides at least one specific stimulus and calls for a relevant response. As a matter of fact, every frame must contain a * specific, and the response must be a relevant response.

~~How could I [illegible] OK [illegible]~~

5)
stimulus; specific
stimulus, relevant.

6)
relevant; specific
stimulus. (or relavant or appropriate
stimulus.)

7)
relevant;
irrelevant;
relevant response.

8)
relevant response;
specific stimulus.

9)
problem;
other half of the
association.

What does this
mean?

10)
the radical sign
($\sqrt{\quad}$);
saying that it
means the square
root of 93. (or
any statement that
means about the
same thing.)

11)
relevant;
specific (relevant)
stimulus.

6.
A response can be completely meaningless unless it is a relevant response and has been "connected" to a * specific stimulus.

7.
"Irrelevant" is the opposite of "relevant". A frame can be useless or confusing, or both, if it calls for an irrelevant response; we always want to call for a * relevant response.

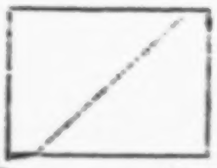
8.
Remember these two critical characteristics of every frame; the response must be a * relevant response and there must be a * specific stimulus.

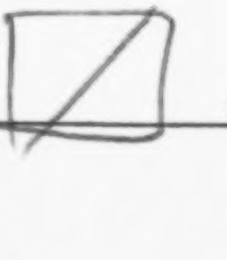
9.
What is meant by a "specific" or "key" stimulus? You can think of it as a question, or problem, or one half of an association. The stimulus for an answer is a question; the stimulus for a solution is a problem and the stimulus for one half of an association is the * relevant response.

10.
When a student sees this: $\sqrt{\quad 93 \quad}$, he should be able to respond by saying that it means "Take the square root of 93". The stimulus in this case is * radical sign and a correct response to that stimulus is: * take the square root of.

11.
The response must be a relevant response, and the stimulus must be a specific stimulus.

12.
Here is another example of a frame without a relevant stimulus: Copy this figure three times.



1.  2. 3.

12)
(No correct figures need to be shown.)

This is the first time relevant has been put with stimulus.

13.
You shouldn't write this kind of copy frame either: Copy this word - "Nird" - write it here, Nird.
Why shouldn't you write a copy frame like this? * no meaningful association

Confusing: First the subject is told not to write this kind of frame; then he is expected to write "Nird" — or is he? Finally, the correct answer turns out to be a term that has not been used before.

13)
There is no relevant stimulus (no meaningful association is being practiced, etc.)

14.
A practice frame to fit this "bad frame sequence" might look like this:
Remember the word you copied in the last frame? Write it again here: nird.
Why is this a "bad frame"? * ____________________.

14)
There still is no relevant stimulus; the response is being practiced without a stimulus being associated with it.

15.
Let's add stimulus content to those last two frames: A frannis bottle is tightly closed by a nird. In order to empty a frannis bottle, you must first remove the nird.
What kind of frame is this? copy.

15)
nird; copy frame.

16.
The cap on a frannis bottle is called a nird. What kind of frame is this? practice.

As it stands it is nothing. It is a practice frame only because it follows frame #15.

16)
nird; practice frame.

17.
"The cap on a frannis bottle is called a nird." Notice the difference? In the "bad frame sequence" there was no relevant stimulus. In the improved sequence, the main part of the stimulus is the name "frannis bottle".

17)
frannis bottle.

18.
A stimulus is not always a word or term. It might include a concept that could be described in any number of ways. "The frannis bottle is tightly closed by a nird. To empty the frannis bottle, you must first remove the nird." The total stimulus is "frannis bottle" plus the concept that a nird is a kind of * stopper.

more than one word?

18)
bottle cap, cork, stopper, lid, etc. The general idea is given by telling that the nird is what keeps the bottle closed.

19.
The total stimulus content of the frame is of critical importance. "Frannis bottle" by itself (is or isn't?) ________ a complete relevant stimulus for the word "nird".

19)
isn't.

20.
"Frannis bottle" plus slightly different contexts becomes a stimulus for other responses than the word "nird".

Is student supposed to do here?

The cap on a frannis bottle is a nird ?.
The color of a frannis bottle is ? .
The purpose of a frannis bottle is ? .

The total context determines the nature of the stimulus contained in the frame, and then determines what respond the student will make.

20)
stimulus;
response.

21.
A gazornenplatt is * blank .
Is the total stimulus adequate? no .
Why or why not?* ?

21)
No. Because there is nothing to indicate what you are to say about a gazornenplatt. (The student could say "a strange word", or anything else, since the stimulus is so vague.)

22.
Here's an example that might make the point a little clearer. Answer this in your own words. George Washington was *________________.

22)
(You could have said almost anything, since there was not a clear stimulus to direct your response in any particular direction).

23.
Even if you try to nudge the frame a little closer to having an adequate stimulus, you might not improve it much. See if you can guess what response goes here: George Washington never* lied .

What kind of frame is this?

23)
saw an automobile.
(An ambiguous stimulus can trick you, can't it?)

24.
In the two preceding frames you could have said many correct things, but not necessarily what the programmer wanted. Look at this improvement. George Washington was the first president of the United States. His home in Virginia was called * Mt. Vernon.

24)
president;
Mt. Vernon.

25.
A frame should never be ambiguous. It should contain a clear and completely adequate ____________ so that there will be no confusion about the *________________________________.

25)
stimulus;
response that is to be given (the nature of the response, etc.)

26.
The next few frames will be examples of adequate and inadequate stimulus content. Indicate whether or not the stimulus content is adequate. "A frannis bottle is * (blank)."

Adequate - go to frame 27.
Inadequate - go to frame 28.

27.
You chose "adequate", but that is the wrong answer. The student could say things like "pretty", "expensive", "capped by a nird", "better than a bucket", or almost anything else he can think of about a frannis bottle. We want the student to practice certain relevant responses, but we have to make it clear just what response we want him to make. O.K. , now go on to frame 28.

28.
That last example certainly was not adequate. The student could not tell whether to talk about cost, size, shape, or purpose. How about this one? A program should always * (blank).

This frame is adequate - go to frame 29.
This frame is inadequate - go to frame 30.

29.
You said that that example was adequate, but you are wrong. What response was called for? The student could say "teach", "proceed in small steps", "be interesting", etc., etc. Go on to frame 30.

30.
The example was inadequate because it did not steer the student toward any particular response, right? Now look at this example: The main difference between a copy frame and a practice frame is *__(blank)__.

Adequate - go to frame 31.
Inadequate - go to frame 32.

31.
Of course it's adequate, assuming that all components have previously been learned. You learned the answer, the stimulus is adequate, go ahead and provide the response. The main difference between a copy frame and a practice frame is *____.

31)
in a copy frame the student can copy the response, but in a practice frame he can't copy it, he must remember it. (or words to that effect.) Now go to frame 33.

32.
You called that frame inadequate, but now you've gone overboard and you are missing the fact that that frame did specify clearly the direction in which the student was to respond. Go back to frame 30, take another close look at the sample, then turn to frame 31.

33.
Now we have reached an important choice point for you. If you can adequately answer this question, you can finish the rest of this unit, but if you can't answer it, you'll be told to return to re-do an earlier part of the sequence. Here's the question. What is meant by a "specific and adequate stimulus"?
* tells student what to do,
has meaningful association.

33)
Check your answer by looking at the next frame.

34.
A specific and adequate stimulus is one that clearly and specifically calls for a response in such a way that the student is in no doubt concerning the nature of the response he is to give (or words to that effect). If your answer was equivalent to this, go on to frame 35, otherwise, go back to frame 5 and do the sequence again.

35.
A response that makes up all or part of the behavior, skill or capability that we want the student to learn is referred to as a relevant response.

35)
relevant.

36.
Here is an example of an irrelevant response: George Washington was the first president of the United ____?____. This response doesn't seem to be very important by itself. "First", or "president", or "United States" could be relevant, but the example looks like an unnecessary practice, so we'd call this an ______________________ response.

36)
irrelevant.

ambiguous

37.
There is a relatively easy - a systematic way - of identifying the relevant responses that we do want the student to practice when given a specific __________.

37)
relevant;
practice (give, make, perform, etc.)
stimulus.

38.
We identify the relevant responses before we write the program, or at least before writing any frames except the criterion frames. We seem to work backwards by writing the criterion frames first.

38)
criterion.

39.
One very effective way of putting down all the objectives of a program for use as a guide in writing, is to write all of the * criterion first. All of the ______________ of the program should be clearly identifiable in these * __________________.

39)
criterion frames;
objectives;
criterion frames.

40.
Another way we make sure every response is relevant is to identify the response to each frame before starting to write the frame. The first step, then, in writing an information frame, is to decide * ______________________________.

40)
what the response should be. (what should go in the blank.)

41.
The first frames you write in a program are the * ____________________.
The first step in writing a frame is * ______________________________.
These two procedures are designed to make sure every response is a __________ response.

41) criterion frames; decide on the response; relevant.	42. Look at this criterion frame: A Neon Tetra is a small fish that lives in the Amazon River. The response (underlined) has two key terms in it. They are: *____________ and*____________.
42) small fish; Amazon River.	43. If we write the sequence so that the student never learns the words"small" or "Amazon", would he learn as much about Neon Tetras? In other words, would this response be adequate? "A Neon Tetra is a fish that lives in a river". Is it adequate?__________.
43) No, not if the objective includes small fish from the Amazon River.	44. We must build in the words "small fish", and "Amazon River". How about the words "lives in"? Are the words essential?________.
44) No.	45. The student could say "lives in", or "comes from", or "are found in", or any other expression of this concept. "Amazon" is a very specific word, but the idea of "lives in", is much more ______________.
ambiguous 45) general (or nonspecific).	46. We can classify the words in a criterion frame as being either specific or ________. "Amazon River" is an example of a ______________ term.
46) general; specific.	47. A frame preceding the criterion frame might say, "A Neon Tetra is a *___?___ that is found in the *___?___. Then the criterion frame could say, "A Neon Tetra is a *_(blank)_____. Would the student be able to add the concept of "is found in" or its equivalent? I don't know - go to frame 48. Probably not - go to frame 49. Probably yes - go to frame 50.
	48. You aren't sure. It isn't always easy to know, but in this case the comcept is pretty clear and the specific terms are the general terms. Most students can probably get it. Go on to frame 51.

49.
You chose "Probably not". Actually, you are probably underestimating the students! They might very well fill in the necessary words. Assume that your choice was "I don't know", and go back to frame 46 for further discussion of this problem.

50.
You said "probably" Yes, and you are probably right. In this case the concept stated in the criterion frame is pretty clear, and the terms "small fish", and "Amazon River" actually cue the general concept "lives in", etc. The student is almost certain to add the necessary words in the criterion frame to have his reponse make sense. Now go to frame 51.

51.
Let's state a general rule. If a word, term, or phrase is very precise in its meaning in the criterion frame, we must use the cue or copy designs to teach it as a response; if the word, term, or phrase is very general and can be stated in a great many ways using non-technical terminology, then we'll expect the general context of the criterion frame to cue the additional words that are necessary. Read this rule carefully. When you feel that you understand it, go on to frame 52.

52.
That was the longest frame in this program! Let's break it into smaller steps. To do that we must back up to a point made earlier. In frame 46 you learned that the words in a criterion frame can be classified as being either ____________ or ______________.

52)
specific;
general.

53.
A word like "Amazon" cannot readily be replaced by some other equivalent word, so we call it a ____________ word. The concept of "lives in", on the other hand, can be replaced by any number of similar terms, so we call that portion of the response a ________________ term.

53)
specific;
general.

54.
If an exact synonym or the word itself are the only acceptable responses, we would refer to these words as very __________ responses. "Small fish" is also a
*
*______________________________, because
____
____.

54)
specific;
specific response;
there is a very limited number of words that could be substituted for that term.

55.
A word or term is considered to be specific if *_________________________
____
______________________________________.

55)
only that word or a very limited number of equivalent words could be substituted and provide an acceptable response.

56.
The term "lives in" can be replaced by "comes from", "grows in", "are found in", "inhabit", and many others. This would be considered a __________ term because
*______________________________________
______________________________________.

56)
general; (the answer was right there in the frame, wasn't it?) because a large number of other terms, using different words, would also be acceptable.

57.
"Amazon River" is considered to be a specific term because *________________
____
____
______________________________________.

57)
You've practiced this before. If you aren't sure, look back at the answers to frames 52 and 53.

58.
The equation A = BC means that * A is equal to B multiplied by C. In this criterion frame, is the term "multiplied by", a specific or a general term?__________ .
Why?*__________________________________
______________________________________.

58)
specific; because the term can be replaced by only a very, very few acceptable substitutes (such as "times").

59.
Pineapple is a * fruit that grows in Hawaii. Is "grows in" a general or a specific term? ____________.
Is "fruit" a general or specific term?
__________________________.

59) general; specific. (what other appropriate substitutes could you use?)	60. Look back at that long, long frame 51 again, read it carefully and answer these questions: If a term that is to be a part of a criterion frame is specific, then you must use *__________ ____________________. When a word or term is general, then *____________________ ____________________.
60) the cue or copy designs to teach it as a response; we expect the context of the criterion frame to cue the general term or words.	61. O.K., now without looking back, write that principle in your own words. You may elaborate as much as you like to express the rule clearly. *____________________ ____________________ ____________________ ____________________
61) Check with the answer to frame 60, and look back at frame 51 to check your response.	62. There is one final point about this rule. When you are in doubt about whether a term should be considered general or specific, play it safe. This means that you should consider any questionable term to be __________ and introduce it by using *____________________ ____________________.
62) specific; the cue or copy designs to teach it as a response. (See why? We said play it safe. This way you are sure to make the term available as a response.)	63. A word, term or phrase can be classified as being either __________ or __________. When in doubt always consider the word, term or phrase to be __________.
63) general; specific; (either order); specific.	64. The basic difference between general and specific terms in a response is *__________ ____________________ ____________________ ____________________ ____________________ ____________________.

64) There are many other terms you could substitute for a general term to express the same idea, but there are few, if any, other ways you can express the idea conveyed by a specific term.	65. You probably noticed that "cue design" and "copy design" were used instead of the longer names for the two designs. We assume that you remember the longer names that are based on the rule that each cue frame and copy frame is to be followed immediately by a *______________ ______________.
65) practice frame.	66. Two ways to insure that all of the responses you call for are relevant, are to write all the *______________ first, and before writing each information frame *______________ ______________.
66) criterion frames; decide what the response is going to be.	67. Every frame must contain a ________ stimulus for a ________ ________.
67) key (specific, relevant); relevant response.	68. To teach a specific word or term that will be part of the criterion frame you *________ ______________ ______________. If the term is general, you *______________ ______________.
68) introduce it in an information frame followed by a practice frame; expect it to be cued by the context.	69. So far you've responded to over 200 frames, made over 350 responses, and, whether you know it yet or not, have learned quite a bit! One final review question: What are the names of the four basic kinds of frames? ________ , ________, ________, ________.
69) cue; copy, practice, criterion.	

DISCUSSION: FOLLOWING CHAPTER THREE.

The concept of relevant response is not a simple one. There are primarily two considerations to keep in mind. First of all, a response has no meaning except in relationship to a specific stimulus, or a number of stimuli. So we must be certain that we are "connecting" or having the student learn to associate appropriate stimuli and responses. Secondly, both you and the student could waste vast amounts of time if you write frames that ask the student to practice responses (saying things, writing things, or doing things) that have little or nothing to do with the objectives of the program. Several units further on in the program you will learn how to write objectives in programmable form. When you get to that point you will learn how to write a table and outline of the objectives, and you will do it in terms of stimuli and responses.

We might, for the present, think of a stimulus as being either a question, an incomplete sentence, or a statement directing you to take some action. The response is the answer to the question, the completion of the sentence, or the action taken. Some parts of the response we must think of as being very specific, which means that little if any variability is allowed in the form of the response. A general response or part of a response, on the other hand, can be given in a variety of ways, within very broad limits. The example of a general response that you saw in the preceding pages was the use of a word or two to indicate that Neon Tetras: *live in*, *come from*, *are found in*, *grow in*, *inhabit*, (etc., etc.) the Amazon River. The specific parts of the response were, *small fish*, and *Amazon River*.

A very useful rule to follow, when writing frames, is to identify the response before you write the frame. This serves the purpose of giving you direction, but it also keeps you from falling into the error of starting to write a frame the way you would a written lecture or textbook presentation, only to find that you made no provision for the student to practice a relevant response. Beginning programmers will often start writing frames this way, and will then erase a word, making it into a blank. Too often this results in an irrelevant response being called for. This is one way that very ineffective and inefficiemt programs can be written. There are many others!

The questions that appear on the next page, it must be admitted, are not easy. Look back, if necessary, to the text above, or even look back into Chapter 3 for the answers.

1. Define "stimulus" as it applies to content of frames.

2. Define "response" as it applies to content of frame.

3. What is the difference between a "general" and a "specific" part of a response?

4. Why do we say that you should decide first what response should be made in a particular frame and then go ahead and write the frame to produce that response?

POST-TEST   UNIT I

CHAPTER THREE

1. What are the two critical characteristics of every frame?

2. a) The words, terms or phrases of a response may be divided into what two classifications?
   b) What is the basic difference between these two classifications?

3. Which of these frames have adequate stimulus content? (If they were to appear at this point in this program.)

   a) A criterion frame is * ______________________________.
   b) A program * ______________________________.
   c) A practice frame never * ______________________________.
   d) Every frame contains both * ______________________________.
   e) You use a copy frame when * ______________________________.

4. Which terms in this reponse are specific?

   On the exhaust stroke the exhaust valve opens and the burned gasses are forced out through the exhaust valve by the returning piston.

5. a) By what design do you teach specific terms?
   b) How do you teach general terms?

6. If you are not sure whether a term is specific or general, how should you teach it?

7. Define "stimulus" as it applies to the content of frames.

8. Define "response" as it applies to the content of frames.

9. Why do we say you should decide what response to call for in a frame before beginning to write the frame?

ANSWERS TO POST-TEST ON CHAPTER THREE.

Question	Frame
1.	5 - 8
2.a)	51 - 62
b)	51 - 62
3. a and b are probably not adequate, while c, d and e probably are. See frames 26 - 30.	
4. exhaust valve, burned gasses, exhaust valve, piston.	
5.a)	51, 62
b)	51, 62
6.	62 - 63
7.	Final discussion section.
8.	Final discussion section.
9.	37 - 40 Final discussion section.

PRE-TEST CHAPTER FOUR

1. List the specific terms in this response:

   Rule 4 is: * Every specific word required by a criterion frame must previously have been introduced in an information frame. Usually the general words will be cued by the context of the criterion frame.

2. Which characteristic of programmed instruction facilitates learning?

3. Which characteristic of "PI" facilitates retention?

4. Why does a program careful' control the stimulus presention?

5. Under what circumstances do we feel that rote memorization is an inappropriate or undesirable way to learn?

CHAPTER FOUR

Chapter Four is a multi-purpose chapter, with some review, a demonstration sequence, and a guide for note-taking. Take out your copy of the APPENDIX that accompanies this program and keep it handy.

This chapter also contains a slightly different style of programming. You will find that part of the chapter is not divided into frames, but is presented in a form called a "Narrative Program". In fact, you have already started the narrative program, beginning with this paragraph.

Before going on to the next set of objectives, let's review the distinction between general and specific words or terms. While fairly broad in its application, this distinction is vital to the programming of verbal concepts, principles and applications of these verbal concepts.

Here's an opportunity to practice identifying some general and specific words. Suppose we are writing a program about the jet engine, and the objectives include the names of all major components and the operation and function of each. One criterion frame might look like this:

The names of the major components of a jet engine are: *___blank___

The student is to respond by saying: "intake, compressor, combustion chamber, ignitor, turbine, shaft, exhaust (or tail pipe)." Would you consider these words to be general or specific?

____________ Why?*____________________________

____

____.

If you are not sure your answer is correct, go back to frame 54 of the last chapter.

Another criterion frame in the program would ask for the function of each component. Or perhaps a series of criterion frames would be used, one dealing with the function of each component, like this:

What happens to the turbine and what does it do? The student is to say: "The turbine is turned by the exploding or burning air and fuel gasses as they move through the turbine blades. The turning rotates the shaft that also has the compressor blades connected to it, so that they also turn, compressing more air." Or the student might say: "As the burning gasses push against the turbine blades, the turbine revolves, and so do the attached shaft and compressor blades, thus compressing more air."

Both answers are adequate, even though they have only a few words in common. Now you write a third answer, although you may not fully understand what every term means. Change as many words as you like, but be sure that all the words you think are specific are contained in your answer.

____

____

____

____

To be correct, your answer must include the names of three specific components of the engine. These three names are __________ _______________ ____________________. Two very important substances are mentioned in both examples, and should be in your answer. These two substances are ____________ and ______________.

The three components are the turbine (or turbine blades), the shaft, and the compressor (or compressor blades). The other two necessary words, the two substances called for are gasses (or burning gasses, or fuel and air mixture, etc.) and air (fresh air to be compressed).

Notice that the three components are specific words, as are the names of the two substances, although some limited synonyms are correct. Now what about the other words in your answer? Additional words are needed to express the sequence of movements involved. These additional words do not have to be specific, do they? There are many ways to say that the exhaust gasses turn the turbine (move it, rotate it, turn it on the shaft, etc.). Using the three specific words for the components and the two specific words, "gasses" and "air", the student must provide his own words to express three essential ideas:

1. Gasses __________________________ the turbine.
2. The turbine and the compressor are ____________ to the shaft, so that as the turbine__________, the compressor also_________________.
3. In other words, because of this arrangement, the exhaust gasses are used to *____________________ ____.

In complete form, those last three sentences should be:

1. Gasses turn (rotate, move, etc.) the turbine.
2. The turbine and compressor are connected (attached) to the shaft, so that as the turbine turns (etc.) the compressor also turns (etc.).
3. In other words, because of this arrangement, the exhaust gasses are used to *compress more air (turn the compressor, etc.)

Many other equivalent words would be perfectly all right to express the relationships involved here. The main point is that we don't want rote memorization of a statement of the relationships. We want the responses to be flexible, so that the student uses the correct specific words, but can express general terms in his own words. This flexibility and ability to provide answers in his own words is part of what we call "demonstrating understanding". Later you will see how, by using many examples, we gradually help the student build statements and descriptions in his own words, that include all the necessary specific words used appropriatly.

In the last paragraph a very important rule has been stated. Now it is time for you to state the rule. Look back to preceding paragraph, if necessary.

> The response to a criterion frame consists usually of both ____________words and ______________words. The student should learn to respond in his own words, describing what happens, but must include the correct
> *____.

Be sure that the completed statement expresses the principle stated above. O.K., now open the APPENDIX to page 8. At the top of the page it says "Rules and Procedures". Find the line that says "Rule Number Three", and in the space write in your own words the rule that you just learned.

Now you must write rules 1 and 2. Rule 1 is an old friend by this time. It is: The rule for introducing an unfamiliar new word is *_______(complete rule)_______________________.
Write the complete rule in the space beside "Rule Number One."
Rule 2 is : If there is an existing association, use a *______
____________, followed by a *_______________________________.
Put rule 2 into the appropriate space. Reword it to make it clearer for yourself if you like,

Rule 4 was taught in Chapter 2 of this Unit: Every specific word required by a criterion frame must previously have been introduced in an __________frame, such as a ____________ frame or a *__________________. We usually assume that in a criterion frame the _________words will be cued by the *_______
____.
Copy or restate rule 4 and put it in the space provided.

Rule 5 is simply a combination of rules 1 and 2: Every information frame must be followed by a *_________________ calling for the same_________________. Put a complete statement of rule 5 into the space provided for it. Ignore, for the time being, the space that calls for a discussion of rules 4 and 5.

Look over the rules, then put the APPENDIX away for now.

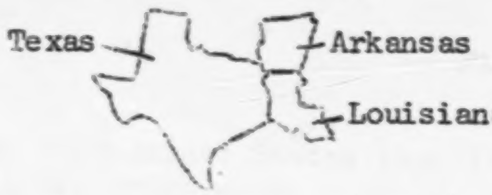
Most of the frames you have seen so far have included both specific and general words. The rest of this chapter consists of a short sequence of frames designed to teach you a rote set of 11 specific items, not in any particular order, but so that you will remember all 11 and not include any wrong terms.

The 11 specific responses are the names of the 11 Confederate States of America. If you already know them, you won't learn anything new, but you will see how a sequence of this sort looks to the student. You will also see how pictures can be used in a copy frame.

Later in this program, when you write your own frames and sequences, you will be referred back to these earlier sequences as samples of various types of frames and programming procedures.

When programming rote learning of specific terms, for example, you will be told to use these next 14 frames as a reference.

1.
There were eleven States in the Confederacy. The three Western-most States were ______________, ______________, and __________________.

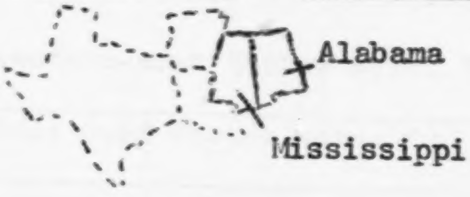


1)
Texas; Arkansas;
Louisiana.

2.
The Confederate States furthest West were ________________, ________________, and __________________.

2)
Texas; Arkansas;
Louisiana.

3.
Two States in the middle of the Confederacy, and along the Gulf of Mexico, w
____________________ and __________



3)
Mississippi;
Alabama.

4.
You've learned the names of five of the Confederate States. The two in the middle were __________________ and __________________. The three that were furthest to the West were:
* ____.

4)
Alabama;
Mississippi;
Arkansas;
Louisiana;
Texas.

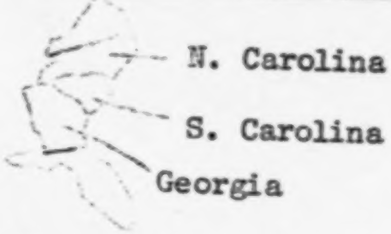
5.
This time write the names or an abbreviation on the right spots on the map.

5)
If you aren't sure, check back to the maps in frames 1 and 3.

6.
There were five Confederate States along the Atlantic coast. Furthest north was ________________, and furthest south was ________________.

6)
Virginia;
Florida.

7.
The five Confederate States that lay along the Atlantic Ocean were: ________________,
________________, ________________,
________________, ________________.



7)
Virginia; South Carolina; North Carolina; Georgia; Florida.

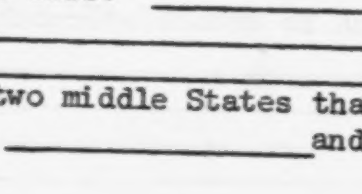
8.
The Confederate States along the Atlantic coast were: * ________________________
____
____.
The two middle States that bordered the Gulf were ________________ and ________________.

8)
Georgia, Virginia, North Carolina, Florida, South Carolina;
Mississippi, Alabama.

9.
The three western-most States were: * ________
____.
The two middle Gulf States were: * ________
____.

9)
Louisiana, Texas, Arkansas;
Mississippi, Alabama.

10.
The five States along the Atlantic coast were:
* ____
____.
The last name for you to learn is the State just above Mississippi and Alabama, which is ________________________.



10)
Florida; Georgia,
South Carolina,
North Carolina;
Tennessee, Virginia.

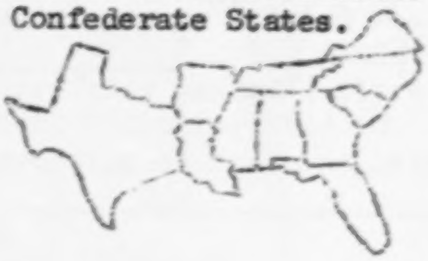
11.
The last State you just learned was
__________________, which lies just
north of ______________________ and
__________________________.

11)
Tennessee;
Mississippi;
Alabama.

12.
The three western States were;
*____.
The Atlantic coastal States were:
*____
____.

12)
Arkansas, Louisiana,
Texas; Georgia,
Virginia, South
Carolina, Florida,
North Carolina.

13.
On the map write names or abbreviations
for each of the Confederate States.



13)
You should have had
no trouble, but, if
necessary, check the
maps in frames 1,
3, 6, 7, and 10.

14.
Now, without a map or anything else to
assist you, write the names of the eleven
Confederate States of America.
*____
*____
____
____
____.

14)
Aren't you glad
there weren't
thirty of them.

15.
Each of the eleven responses was very specific. The student could not answer the criterion frame in his own words, except for changes in order. But it would just not do to slip in Kentucky or Pennsylvania! Go on to frame 16.

16.
That sequence took 14 frames. Do you think the sequence could have been written any shorter without losing any of its effectiveness? __________________.

16)
Perhaps! It is
always debatable,
at least until
students try it
out for us so
we can see.
But see
frame 17.

17.
Suppose we had used only two frames, like this: (1) Here is a list of the eleven Confederate States. Memorize it, then go to the next frame. (2)(Criterion frame) Name the eleven Confederate States. Can you think of any advantages that the programmed sequence would have over this two-frame version? Think it over, and then go on to the next frame.

18.
There are namy reasons. Probably the two most important are; controlled practice, and controlled small-step presentation. You learn more easily because of the controlled *____________________, and you remember better because of the

____________ ________________.

18)
small-step
presentation;
controlled
practice.

19.
Learning is facilitated by *__________
____________________________ and
retention is facilitated by *__________
____________________________________.

19)
controlled small-
step presentation;
controlled practice.

20.
The one word that was common to both of the characteristics you just stated was the word "____________". You could also use the term "carefully guided", since the one most important characteristic of programmed instruction is that the learn= ing is *__________________________
by the program.

20)
controlled;
carefully guided.

21.
If a student is told to memorize a list of words, or learn something from a textbook, he is pretty much on his own, but a program provides both *__________________of the material, and *________________of his responses, so that all of his learning is *________________________________.

21)
controlled small-
step presentation;
controlled
practice; care-
fully guided.

22.
That last frame probably caused you a bit of difficulty. It was intentionally written that way to be difficult. You may have allowed no variation in answering the last few frames; each response word or term is classified as being
____________rather than____________.

22)
specific;
general.

23.
But there are easier ways to express the same principles. Since "small-step" refers to a stimulus, and "practice" refers to a response, we can simplify the whole statement and say a program controls the
____________presentation in order to provide careful guidance of the student's ____________________.

23) stimulus; responses (or, responding).	24. Now combine the things you learned in the last six frames. A program controls the *__________________________. For what purpose?*_______________________________________.
24) stimulus presentation (or, presentation of material, or, size of each step, etc., etc.); In order to control or guide the student"s responses, or his practice, etc., etc.).	25. One last thing, as a review: Name the eleven States that made up the Confederacy. Just say them to yourself, then proceed to the discussion.

DISCUSSION: FOLLOWING CHAPTER FOUR.

In Chapter Four you went through a short sequence that taught you the names of the eleven Confederate States of America. That sequence dealt with rote memorization. Many people, when they first hear about programmed instruction, jump to the conclusion that programs can teach only rote names, dates, use of a formula, or some mechanical, "non-thinking" skills. Actually, there is little restriction on the kinds of things that can be successfully programmed. You are learning many things from this program that would be considered ideas, principles, concepts, generalizations, and other "higher level" skills. The program cannot be successful unless it does teach you both the rote and conceptual objectives set for it.

|| Really?

Yes, some objectives do involve rote memorization in this program as well as in any course of instruction. Don't get the idea that rote memorization is a Bad Thing! The only time that educators feel that rote memorization is undesirable is when it occurs instead of conceptual and generalizable learning. For example, if a student or trainee were to memorize the rules that you wrote into the APPENDIX - memorize without any understanding or ability to explain, elaborate, give examples, or apply the rules - we would consider rote memorization in that case inappropriate and undesirable. We want you to think about the rules as you learn to state them in your own words, for in this way they can be useful to you. There are many kinds of objectives that appropriately involve rote memorization, perhaps only much later to be followed by "conceptual understanding".

Question: Under what circumstances do we feel that rote memorization is an inappropriate or undesirable way to learn?

Here is a slightly different kind of review exercise, which will involve some extensive recall and creative writing on your part. Take out the APPENDIX and open it to page 8, where you wrote the rules. Now look over at page 9 EXPLANATION OF RULES ONE THROUGH FOUR. On this page you have an opportunity to write a summary explanation of each of these rules, in your own words and in any form or style of explanation that you care to use. As you write these explanations, keep this purpose before you: each explanation should be so complete that if someone who has not gone through this program were to ask, "What does this rule mean?", your explanation would make it pretty clear to him. Remember that purpose as you write each explanation, and be as clear and precise as you can. It might be a good idea to work out each explanation on scratch paper first, to get it in good shape before you put it into the appropriate space on page 9.

If necessary, you may refer back to earlier units of this program for information you need to do a good job on this assignment.

You have one more task before you are finished with Unit I. At the end of the program, just before the APPENDIX, you will find the "Narrative Reviews". At the end of each unit you are to read the narrative review for that unit before going on to the next.

We will discuss the purpose of the narrative review more fully later in the program. Essentially, here is the theory behind it: now that you have learned certain stimulus-response relationships, you will be able to make the same responses covertly (thinking) to the same stimuli, with or without the blanks. We hope the narrative review will be a more interesting and efficient way for you to practice the responses you have already learned.

Turn to the last chapter and read the "Narrative Review for Unit I", thenbegin Unit II.

POST - TEST UNIT I.

CHAPTER FOUR

1. List the specific terms in this response:

   Rule 4 is * Every specific word required by a criterion frame must previously have been introduced in an information frame. Usually the general words will be cued by the context of the criterion frame.

2. Which characteristic of programmed instruction facilitates learning?

3. Which characteristic of "PI" facilitates retention?

4. Why does a program carefully control the stimulus presention?

5. Under what circumstances do we feel that rote memorization is an inappropriate or undesirable way to learn?

Answers to Post-Test on Chapter Four.

Question	Frame
1.	Discussion preceding frame 1.
2.	18 - 22
3.	18 - 22
4.	23 - 24
5.	Final discussion.

UNIT II

INTRODUCTION TO UNIT II

Unit I dealt with the basic terms, concepts and techniques of programming. The four chapters of Unit II will give you a chance to practice some of those techniques.

In Unit II you will finally apply the rules you have learned as you write some model frames and sequences. You will be closely guided by this program, and may turn for help at any time to the rules you listed in the APPENDIX. Be sure to save the models and sequences you write, because you will be asked to refer to some of them later in the program. Another important part of Unit II is a discussion of the techniques and purposes of adaptive sequencing.

UNIT II

PRE - TEST CHAPTER FIVE

1. What is wrong with this sequence?
   a) Denver, Colorado, the capital and largest city in the state, is called the "Mile High City". It is because of its exact altitude, 5,280 ft., that Denver is known as the *________________.
   b) The capital city of Colorado is ____________.

2. And what criticism would you make of this frame?
   Denver is located in the north central part of Colorado. Denver is situated in the ________ ________ part of Colorado.

3. How must every specific word or term be introduced? Why?

4. Write a cue frame: (desired response is underlined)
   The Lhasa Apso is a breed of dog.

5. Write a practice frame for your cue frame.

6. Write a copy frame for: The Lhasa Apso breed originated in Tibet.

7. Write a combination frame to follow the copy frame you wrote for question 6. Here is some new information: Buddhist monks raised the Lhasa Apso to serve as warning guards in the palace of the Dalai Lama.

8. Write a criterion frame to follow the frames you wrote for questions 4 - 7.

But when a student can get the correct answer from syntax and recently activated vocabulary, ← what is he really learning?

UNIT II CHAPTER FIVE

In this chapter you'll finally get a chance to write a frame sequence, with a lot of help from the program. We'll also point out a couple of glaring errors often made by beginners.

1.
How is your memory? The criterion frame for the "Neon Tetra" sequence should be mostly in the student's own words, but must contain the terms * ____________ and * ________________________.

1)
small fish;
Amazon River.

2.
If a frame says, "A Neon Tetra is a blank blank", the student will not say "Amazon River", nor will he give the color or shape. Why not? Because of two small but very important words in the stimulus part of the frame. The two words that tell you what to say about Neon Tetras are the words "______", and "__________".

2)
is , a.

3.
"A Neon Tetra" is a small fish found in the * blank . The words that tell the student to say where Neon Tetras come from are the words __________, ___________, and ______________.

3)
found,in,the.

4.
What is a Neon Tetra? Where do Neon Tetras come from? These stimuli are clear. We can write the first question like this: A Neon Tetra is a blank blank . Now you rewrite the second question as an incomplete sentence. Be sure the stimulus is clear.
* ______________________________________
______________________________________.

4)
Neon Tetras come from (live in, are found in, etc.) the * blank (or instead of *blank you could have used blank blank).

5.
Remember, in each frame there must be a
* ____________________________ and a
* ____________________________.

5) relevant (specific, key, appropriate, etc.) stimulus; relevant response.	6. Here is a sequence with a very bad flaw in it. Work the sequence without looking for the flaw. You may notice it immediately. If not, it will be pointed out later. 1) The four strokes in a gasoline engine are, in order: intake, compression, power, and exhaust. The first stroke is the __________ stroke.
6) intake.	7. 2) The first stroke is the __________ stroke. The second is the __________ stroke.
7) intake; compression; (Here, let's emphasize the problem. The 3rd stroke is the __________ stroke and the 4th is the __________ stroke. Could a student who did not previously know these answers have learned them all from that first frame?	8. That two-frame sequence was bad because, in the first frame you copied only one word and practiced it in the next, but the second frame asked you to respond with a word that had never been either cued or copied! This is a violation of the rule that says every specific word must be introduced in either a *__________ __________ or a *____________________. That rule (check the APPENDIX) is rule number __________.
8) cue frame; copy frame; Rule 4 (if you said 1, you missed part of it).	9. Let's review. A frame amy be classified as an information frame, such as a *__________ __________, or it may be a criterion frame or a *____________________. Actually, a criterion frame is simply a more complex __________ frame.
9) copy frame, cue frame; practice frame; practice.	10. A practice frame assumes that the response was introduced previously in one of the two kinds of __________ frames. Can a response be called for for the first time in a practice frame? __________.
10) information; No, not according to the rules we've set up. Even a very, very familiar response is called for first in a cue frame of some sort (there are kinds of [illegible]	11. Now consider that rule number 4; also consider frames 6 and 7, those two "bad frames". Do you understand why they were bad, and why we have rule number 4? No - go to frame 12. Yes - skip to frame 16.

information frames
that you haven't
learned about yet,
but will learn soon).

12.
O.K. In that "bad sequence" the word "first" was the key stimulus for the response "intake", but in the first frame no response was made to the word "second". If, in frame 2 we present the stimulus "first", we can expect the response "intake", and if we present the stimulus "second", what response can we expect?

Intake - go to frame 13.
Compression - go to frame 14.
Neither - go to frame 15.

13.
Intake? Well, that response will be made to the stimulus, "first", since in the first frame we established an association between that stimulus and that response, but "first" will not produce the response "compression". We wouldn't want it to! The stimulus for the response, "compression" should be the stimulus word "_____________". Go back to frame 12 and answer again.

13)
second.

14.
Compression. Wrong. We can count on an association being established only if we can be sure that a definite response has been made to a specific stimulus. Since we did not require the student to say "compression" in response to "second", we can't be sure that any association was established, can we? Go back to frame 12.

15.
Neither. That's right. We want to be sure that every desired stimulus-response (S-R) association is systematically established. We assume that an association is established when we provide systematically for a response to occur in the program. We don't feel that we can depend on other associations being reliably established simply because a student read about them! Go on to frame 16.

The problem is not that the student is learning 3 new words. Rather, three words are being activated and profoundly associated with new ideas. ~~If~~ ~~the process of~~ ~~the~~ If the association is to be learned, then more has to be done than merely writing the words

16.
If frame 1 lists three new words, and only one is copied, we ~~don't expect~~ the students to be able to produce all three in frame 2 because:
No student could remember all three - go to frame 17.
Some students won't remember all three - go to frame 18.
They'll all remember all three, this is a stupid rule! - go to frame 19.

17.
You are seriously underestimating the ability of students. Many students are good readers, who remember very effectively what they read and would be able to produce all three words. Now go back to frame 16 and answer the question correctly.

18.
You are correct! Some students will not remeber all three words. We want to write our programs so as to maximize the probability of every student getting every answer correct and learning every objective in our program without practicing errors (which is what the student does every time he makes a mistake!). Reading, we know is not reliable enough to count on. Skip to frame 20.

19.
Don't like our rule, eh! Using an information frame to introduce every specific term may sound like a very tedious process, but it does pay off. It is important that every student make as few errors as possible. The use of a cue or copy frame insures that the student will make the correct response to our stimulus. (Control remember?) The correct answer to frame 16 was "Some students won't remember." Assume you chose that as your answer, and turn to frame 18.

20.
If the student writes or says the answer we expect, he is practicing the correct answer. However, if he makes a mistake, he is *__________________________.

20) practicing the wrong answer.	21. We don't want the student to make any mistakes because *____________________ ____.
21) We don't want him to practice the wrong answer. (He'd be practicing the wrong answer).	22. Look at this frame sequence: (1) A program consists of small steps and requires active responses. Every good program consists of many blank. blank. (2) A program consists of *__________ and requires *__________. Does this sequence violate the rule we just discussed?________________.
22) yes.	23. In what way did the two sample frames shown in frame 22 violate the rule? *____ ____ ____.
23) In frame 2 the second response called for was "active responses", which the student had only read in frame 1, but which had not been a response, etc.)	24. So far you have learned a number of rules and other considerations, but you will never learn to write frames unless you progress beyond learning the rules. To learn to write frames you must actually practice ______________ ______________.
24) writing frames.	25. Here's a criterion frame: An Alfa Romeo is a * sportscar that is made in Italy. The stimulus is "Alfa Romeo". The response contains two specific terms. They are: ________________and __________.
25) sportscar; Italy.	26. To begin with, you know two designs for introducing specific responses: the *________________________design, and the*________________________design.
26) copy-practice; cue-practice.	27. If you can think of an existing association, you will use the *______________ design. Can you think of an existing association that is almost universally known - an association between some word or term and the desired response, "sportscar"? Yes - go to frame 28. No - go to frame 29.

28.
This was not meant to be a trick question; we wanted you to try to think of an existing association. You apparently feel that you did think of one that will work, but most people are not very familiar with sportscars, their names or characteristics. We better assume that no universal association exists. Go on to frame 29.

29.
There probably is no universal association for "sportscar", but perhaps we could find an association for "car". Think of the Neon Tetra frame that used existing associations for the word "fish". Can you think of a similar frame for the response "car"?

No - go to frame 30.
Yes - go to frame 31.

30.
You can think of an association to use if you'll work on it for a minute. The names of well-known manufacturers should do, and you can write a frame very similar to "Tuna, trout, and bass are all blank". Keep this example in mind and go to frame 31.

31.
O.K. Take a piece of paper and write the cue frame you have thought of. Rewrite it until you feel it is adequate. Be sure the stimulus is present. Then turn to frame 32 and see one way the frame might be written.

32.
Your frame might look like this: Chevrolet, Ford, Plymouth and Alfa Romeo are all names of blank. Or this: Alfa Romeo, like Ford, Chevrolet, or Plymouth, is the name of a blank. Does your frame resemble either of these? If so, don't change it; if not, fix it.

33.
The frame that comes after an information frame is always a ____________ frame in which the student must ____________ the ________________ response again.

33)
practice;
practice;
same.

34.
On the sheet of paper where you wrote your cue frame, write a practice frame for the response "car", with the key stimulus "Alfa Romeo". Then turn to frame 35.

35.
Your practice frame could be as simple as this: An Alfa Romeo is a blank. The two frames you just wrote for practice, illustrate the *____________ ________ design.

35)
cue-practice.

36.
But our problem is "sportscar", not "car". How about this? Austin Healy, MG, Porcshe, and Alfa Romeo are all names of ________. As a cue frame would this frame work for most adults? __________.

36)
No. Many adults could not fill in that blank, because the names of sportscars are not really widely known.

37.
We probably can't write an effective cue frame here, so we'll have to write a copy frame. There must be a blank for the response; the word "sportscar" must appear (once; twice; not at all)________, and the words "Alfa Romeo" must appear (once; twice; not at all) ___________.

37)
once (so the student can copy it into the blank);
twice (once along with the word "sportscar", and once along with the blank.)

38.
The stimulus to which we want to connect the response, "sportscar" is the name "*______________________".

38)
Alfa Romeo.

39.
The first sentence should contain the stimulus, perhaps along with the names of similar cars or their characteristics, and the word "sportscar". The second sentence should contain the stimulus and a blank for the response plus any general words needed. Write a copy frame incorporating these points. When you are satisfied with it, go to frame 40.

40.
First, check these points: Sentence one should contain the stimulus, the word "sportscar", and some general information. Check your frame. O.K.? Sentence two should contain the stimulus name "Alfa Romeo"; and a blank for the response. O.K.? Fix the frame if necessary.

41.
DON'T EVER WRITE A COPY FRAME LIKE THIS: An Alfa Romeo is a sportscar, Yes, an Alfa Romeo is a blank__________. It is simple, yes, but it's dull and it doesn't stimulate much thinking, does it?

42.
Your copy frame might look something like this: A small, powerful car, such as an MG, a Porsche, or an Alfa Romeo, is called a sportscar. An Alfa Romeo is a fast, small, and very well-built blank_____. Don't bother to change your frame just to make it look like this one.

43.
In that frame the student was allowed to ____________ the word "____________". You know that in the next frame the student must *______________________
______________________________.

43)
copy; sportscar; practice the same response but not copy it.

44.
Now write the practice frame. The stimulus must be part of the frame, and must clearly call for the response. If you like, add a comment or two about size, power or any other general characteristics, to add some context and interest value.

45.
The basic content is: An Alfa Romeo is a __blank__. You might have added variety in this way: An Alfa Romeo, like a Porsche or Triumph, is a foreign-built, small, powerful __blank__________.
Don't change your frame if it looks pretty good to you.

46.
In the next frame we want to introduce the word "Italy". The rule is, if possible, use a ___________ frame, otherwise use a _____________ frame.

46)
cue; copy.

47.
Use your paper and try to write down several associations, each to include the word "Italy". Write down several associations, then go on to frame 48.

48.
Were you able to write down two or more associations including the word "Italy"?

No - go to frame 49.
Yes - go to frame 50.

49.
What, no associations for "Italy"! How about these?
Spaghetti, lasagna and pizza are all foods from ___blank___. Rome and Venice are cities in the country of ___blank.___. Mussolini was the dictator of ___blank___.
See? Now go on to frame 50.

50.
There are many associations for "Italy". For example; Rome, spaghetti, Vatican, Venice, etc., etc. The association "____________" will be the response. The new association that is to be built is between the stimulus "*____________" and the response, "___________".

50)
Italy;
Alfa Romeo;
Italy.

51.
Now go ahead and write the cue frame. If necessary, look back at the last two frames for guidance. After you have written the frame, go on to frame 52.

52.
Now check your frame. Is "Alfa Romeo" clearly the stimulus, and is the frame written so that it is clear that the response to go in the blank is "Italy"?

53.
The primary purpose of this frame is as a cue frame for the response, "Italy". Is it against the rules to include in this same frame another opportunity to practice the word, "sportscar"?

Yes, it certainly is - go to frame 54.
No, it is not - go to frame 55.

54.
What gave you the idea that you can't cue a new response while having the student practice an old one? It is a very effective and convenient procedure. There is no rule against it, and we'll do it wherever possible. Go on to frame 55.

55.
We can effectively combine cuing a new response and having a student practice an old one. We call this kind of frame a combination frame. If we do write a combination frame instead of the cue frame you just wrote, what are the two responses we want the student to use?
______________ and _______________.

55)
sportscar;
Italy.

56.
And what is the stimulus for "sportscar"?
* ___________________.
And the stimulus for "Italy" is to be
* ___________________.

56)
Alfa Romeo;
Alfa Romeo (in the new association).

57.
A combination frame here might look like this: An Alfa Romeo is a ___________ built in the country in which the Leaning Tower and the Vatican are located. Alfa Romeos are manufactured in __________. Don't rewrite your frame to make it a combination frame, leave it a cue frame.

57)
sportscar;
Italy.

58.
The next frame must be a _____________ frame for the response, "____________". Write the frame, and use it to call for both specific responses.
Then go on to frame 59.

58)
practice;
Italy.

59.
The frame should say, approximately;
An Alfa Romeo is a blank made in blank. Now write the criterion frame with only the very minimum stimulus content, then go on to frame 60.

60.
The criterion frame should not contain much more than this: An Alfa Romeo is a * sportscar that is built in Italy (or an equivalent response). Suppose a student says simply, "Italian sportscar". Would that be an acceptable response? __________.

60)
Yes (certainly it would be acceptable. It expresses the complete idea that the criterion frame is to contain).

61.
Look again at your criterion frame and the one immediately before it. The criterion frame calls for words that have never been cued or copied, yet they, or equivalent words, should easily be provided by the student. What do we call words of this sort? ___________words or terms.

61)
The correct response was "general". If you did remember that word, skip to frame 63, but if you did not remember that word, go on to frame 62.

62.
You didn't remember! We devoted most of an entire unit to this concept. Specific words or terms must be cued or copied, while general words or terms can usually be cued by the specific words contained in the criterion frame. Now go on to frame 63.

63.
We expect the student to provide general words in the criterion frame. The specific words "sportscars" and "Italy" should provide enough cuing in the criterion frame for the student to be able to complete the concept. Go on to frame 64.

64.
O.K. Take a look at this sequence:
1) The guitar descends from the lute of the middle East. Yes, the guitar descends from the ______________.
2) The grandaddy of the guitar is the ______________from the *______________ ____________.

What criticism would you make of frame 1 alone in this sequence?
*____
____
____.

64)
It is dull, doesn't inspire any thought, doesn't require the student to even read the frame! etc.,etc. If you missed this, go back to frame 41.

65.
And what error becomes apparent in the second frame of the sample sequence?
*____
____
____.

65)
The second response in the frame, "Middle East", was never cued or copied, had never been a response before, had only been read, etc. If you have any doubts about frame 65, go through frames 6-19 of this chapter again!

66.
Here's one other point. Review is very important in a program. Without it the student would learn but then forget. A criterion frame or any practice frame used later in the program could be called a review frame. For example, try to practice each of the rules you've learned so far. Don't write them down, just think of them. If you can't, refer back to the APPENDIX. When you have finished this review, go on to the discussion.

I believe the emphasis on words rather than ideas is a mistake. In spite of the author's earlier assertion that if you teach words you teach concepts, I doubt that you'll find this the case with students

DISCUSSION FOLLOWING CHAPTER FIVE.

Why must every specific word, term, or concept be introduced in an information frame? For one thing, as you learned in chapter five, we want to maximize the probability that every student is able to answer every frame correctly. Otherwise, he is practicing errors. We are not sure he will remember material introduced in a previous frame if he has only read it and not made an active response to it. Hundreds of psychological studies and, indeed, our own reading experience have convinced us that reading is an unreliable learning experience. Usually as we read we make many responses to many stimuli. We remember the material we respond to, but generally in an inefficient manner. We respond to (learn) illustrative material that is not important, and fail to learn the essential concepts and facts, or learn incorrect relationships. This is one of the reasons we usually have to read a textbook assignment more than once.

The textbooks and the programs that a student reads are both designed to provide maximum guidance, but the program can do something that conventional textbooks cannot. An educational psychologist, E. L. Thorndike, said that if we could devise a method of controlling the student's progress through a book, we could then begin to make textbooks into far more effective teaching devices. Thorndike suggested that one way to do this would be to invent a way to be sure the student had learned page one before allowing him to go on to page two. In a program we do attempt to control the student's progress, not by pages, but by the smaller units we call frames.

When a student reads a frame, he is given a very carefully structured opportunity to make a response to a certain stimulus. The program insures that the student responds to the important material. As he reads a frame, responds to a stimulus, and goes on to the next frame, we can count on his "taking with him" the association of stimulus and response he just practiced. He will also take other associations with him, but, as in the case of unprogrammed material, we cannot count on any association unless it is based on the occurrence of a response. In summary then, a student learns when he responds, and that is why a program asks for active responses to all the essential information. When a student simply reads, he may or may not learn the important material. || ?

Here is another important point. If you write a program that continually calls for responses that have never been practiced in an information frame, the student will discover that he must memorize every frame in order to be able to make responses later on. This is neither desirable, efficient or necessary if the program is well written.

All right, now make a few active responses before going on.

Why do we have rules 4 and 5, which insist that every specific term be introduced in a cue or copy frame?

I don't know, and I doubt that they are valid rules.

What kind of guidance does a program give a student that a conventional textbook cannot?

Your first answer should say that a specific word must be introduced in a cue or copy frame because in this way we can be sure the student will be able to recall these responses when they are required later in the program. It is a way to control the student's responses and prevent him from practicing errors. Write your reason for rules 4 and 5 on Page 8 of the APPENDIX, in the space provided. Your second answer should indicate that a program guides a student by controlling the learning situation in such a way that the student must respond to, and thereby learn, the important material. The programmer, rather than the student, decides what is essential to remember, and makes sure the student remembers it by asking for active responses.

This really the problem? activating an already acquired vocabulary and there is no assurance, as far as I know, that cue or copy frames assure this.

CHAPTER FIVE POST TEST.

1. What is wrong with this sequence?
   a) Denver, Colorado, the capital and largest city in the state, is called the "Mile High City". It is because of its exact altitude, 5,280 ft., that Denver is known as the *________________.
   b) The capital city of Colorado is ______________.

2. And what criticism would you make of this frame?
   Denver is located in the north central part of Colorado. Denver is situated in the _______ _______ part of Colorado.

3. How must every specific word or term be intoduced? Why?

4. Write a cue frame: (desired response is underlined)
   The Lhasa Apso is a breed of dog.

5. Write a practice frame for your cue frame.

6. Write a copy frame for: The Lhasa Apso breed originated in Tibet.

7. Write a combination frame to follow the copy frame you wrote for question 6. Here is some new information: Buddhist monks raised the Lhasa Apso to serve as warning guards in the palace of the Dalai Lama.

8. Write a criterion frame to follow the frames you wrote for questions 4-7.

ANSWERS TO POST-TEST CHAPTER FIVE.

1. The first frame, the copy frame, we'll pass, but the second frame violates that basic rule that says that a practice frame should only call for a response previously cued or copied. The answer to the second frame, "Denver", was not used as a response previously, at least not as far as you can tell from this question. One other point we might make is that after a number of frames in which "Denver" appears as part of the stimulus, you might very well find that all students can produce it as a response to a practice frame without having first used it in an information frame. Remember that, we said after a number of frames, meaning three or four or more, and we don't really recommend this unless your entire student group is pretty sharp!

2. This is that deadly dull kind of copy frame that has also been called a "no think copy frame".

3. In an information frame, because we want to be sure that the specific term is used.

4. You might have used that form we followed before: A Lhasa Apso, like a Collie, St. Bernard or Bloodhound, is a kind of ______. But you might have taken a different tack and said, "Do you know what a Lhasa Apso is? Probably not, but if we said it is one of 'man's best friends', you could guess that a Lhasa Apso is a kind of _____". See, here we used a different form of existing association to cue the response.

5. A minimum would be: The Lhasa Apso is a breed of _______. You might try to perk it up a bit by adding a little more content (for interest value only; don't expect the student to learn the added content). The Lhasa Apso is a fairly large and quite ferocious ________.

6. Hope you avoided the kind of copy frame shown in question 2! You might have written something like this: The name "Lhasa Apso" is Tibetian, since that breed of dog was first developed in the country of __________. That's a copy frame even though the form "Tibetian" is a bit different from the desired response, "Tibet". Perhaps if that frame didn't work, you could change it to: A group of Buddhist monks in Tibet developed the Lhasa Apso breed of ______. In fact, to this day very few Lhasa Apso's are to be found except in the country of ___________.

7. The new response must be copied since it is unlikely that you could cue that response. You also want the student to practice "Tibet".

Buddhist monks first bred the Lhasa Apso to guard the Dalai Lama, one of the rulers of ________ __________.

The Dalai Lama himself was one of the group of *______________
who developed the breed.
This frame might not work! The student may miss the second blank, or at least find it difficult.

8. For a criterion frame, you might have written something like this:

Direct question.
What is a Lhasa Apso? Tell everything you know about it.

Incomplete sentence.
A Lhasa Apso is a *____
____.
(tell everything you know about it).

PRE-TEST CHAPTER SIX

1. How does a program make sure the student is learning the material, rather than just reading or hearing it?

2. What are the first two things you do when you start writing a program? Why?

3. What is the rule about 2-way S-R connections?

4. Arrange these procedures in the proper order:
   Revise; write first draft of frames; put it away for a couple of days; try the frames out on a student; first edit.

5. What is a "mediator"?

6. What is the difference between an "internal mediator" and an "external mediator"?

CHAPTER SIX.

You are going to write another sequence in this chapter, and learn more about the procedures that come before and after the actual frame writing. You'll also pick up a new term and new rule.

1.
In Chapter 5 you wrote a short sequence of frames. Suppose a student taking a program encountered your frames and it took him 40 seconds to complete them. Do you think you could tell him the same information in less time?

No - go to frame 2.
Yes - go to frame 3.

2.
You say you couldn't! Of course you could. It would take only a couple of seconds to say, "An Alfa Romeo is a sportscar made in Italy". And the student would certainly not have any difficulty understanding it, would he?

3.
You could tell him in just a few seconds, and he'd understand. So what is the big deal about a program? Well, first of all, can you think of any real difference between hearing an explanation, and learning an explanation?

Yes, there is always a difference - go to frame 4.
No, there is never a difference - go to frame 5.
Yes, there can sometimes be a difference, but not always - go to frame 6.

4.
You say that there is always a difference. Not necessarily. Sometimes hearing and learning occur at the same time. It all depends on what you hear, how you respond, and the relationships involved. Skip ahead to frame 6.

5.
You say that there is never a difference. That is not true. You have probably listened to a lecture, only to discover later that you really learned very little. Go back to frame 3 and select a better answer.

	6. Sometimes there is a difference, but sometimes not. It depends, in part, on whether you respond actively to what you hear. A passive listener might learn nothing. So to be sure you are learning, the program is designed so that you can not be passive, but must make __________ responses.
6) active.	7. When a student responds to a cue frame, for example, he must make an __________ response, practicing the *______________ ______________________. Remember, in a cue frame you are trying to build a *________________________based on an *__________________________________.
7) active; relevant responses (or correct answer); new association; existing association.	8. The student will learn the new ___________ by practicing them. He will make the *__________ _____________to each *__________________.
8) associations (responses); relevant response (or correct response); relevant (appropriate, key, etc.) stimulus.	9. Now let's write another sequence of frames. First we must write all of the __________ for the sequence, then, from them, write the __________________frames.
9) objectives; criterion frames. This is a very important point. If you were correct, skip to frame 12, otherwise, go on to frame 10.	10. Be sure to read the answer to the last frame. (to the left of this frame) You missed frame 9, probably by saying you would first write a cue or copy frame. Before we write the sequence we always write the ______________of the program, and then the _____________frames.
10) objectives; criterion.	11. Practice that once more, in your own words. What are the first two things we write when starting a program? *__________________________________ __________________________________ __________________________________.

All right, now make a few active responses before going on.

Why do we want the student to be able to answer every frame correctly?

What kind of guidance does a program give a student that a conventional textbook cannot?

Your first answer should say we want him to answer correctly because we don't want him to practice errors. Your second answer should indicate that a program guides a student by controlling the learning situation in such a way that the student must respond to, and thereby learn, the important material. The programmer, rather than the student, decides what is essential to remember, and makes sure the student remembers it by asking for active responses.

11)
First we write the objectives, then the criterion frames.

12.
However, in this case, the objectives are taken care of for you. We will walk you through the sequence without even showing you all of them. Here's the criterion frame:

(a) $I = \frac{V}{R}$	$R = ?$	$V = ?$
(b) $Q = ST$	$S = ?$	$T = ?$

Write this frame at the top of a clean sheet of paper.

13.
Your immediate reaction, in spite of the comment made in the preceding frame, might be that you don't know what the objectives are, and therefore, can't see where we are going. Just trust the program for now. Later we'll work on the problem of objectives, coming back to this sequence to see why each step was taken. Basically we want to teach the student a short way to solve the equations in the criterion frame, and others like them.

14.
The sequence will deal with equations consisting of three letters, one to the left of the = sign, and two to the right. Add one more example to each of these sets:

Multiply: $A = BC$; $J = RQ$; *___________

Divide: $F = \frac{G}{B}$; $R = \frac{L}{S}$; *___________

14)
Mult: letters on the right are side by side. Div: letters on the right, one above the other.

15.
Let's consider the first thing we want to do. The term, "multiplication example" is to become a stimulus for the response, "X = YZ (or any other example). If we show the student the example, "X = YZ", what response would we probably want?
*

____

15)
Well, if he says, "It means X is equal to Y multiplied by Z", he'd be correct, but we want another response too. See frame 16.

16.
The response to the stimulus "X = YZ", plus the words, "What is it called?", should be, "multiplication example". Is it also possible for "multiplication example " to be a stimulus?

Yes - go to frame 17.
No - go to frame 18.

17.
Of course. In fact, frame 15 said to begin with that we want "multiplication example " to be the stimulus. Think over what we have just said, and answer this question: What do you think is meant by a "two-way S-R (stimulus-response) connection"?

*____
____.

17)
If you really have no idea, or want more information, skip to frame 19. If you are pretty confident your answer is adequate, skip to frame 20.

18.
You said "No", but that's wrong. We can use almost anything as a stimulus. In fact, frame 15 said we are going to do exactly what you say cannot be accomplished. Go back and read frame 17 for the correct answer.

19.
You need more explanation. O.K.. Here is an example of a two-way S-R connection. Samuel Clemen's pen name was __________ __________. Now turn it around: Mark Twain was the pen name of __________ ______________. In the first sentence Samuel Clemens was the stimulus, and in the second it was the response. Now go back and answer frame 17.

20.
A two-way S-R connection (sometimes called S-R pair, S-R unit, or S-R association) is one in which each element is a response to the other element and a stimulus for it. For example, if "X=YZ" is the stimulus, and "Multiplication example" is the response, then it also works the other way: "multiilplication example" is the stimulus for "X=YZ" as a response. If it is still not clear, go back and study the example in frame 19. Otherwise, go on to frame 21.

21.
I know you are getting impatient to get on with the frame writing, but this question of two-way versus one-way S-R units is important. Remeber the sequence on the Alfa Romeo? The stimulus was Alfa Romeo, and the response was:
*____________________________________.

21)
a sportscar made in Italy.

22.
This point might be difficult for you to accept, but a student could go through the sportscar sequence, getting every response correct, and then later be unable to tell you the name of the sportscar made in Italy. Take a deep breath and try to guess why. *__________________________
_______________________________________.

22)
Because he never gave "Alfa Romeo" as a response. He had only seen it and responded to it. He never practiced it as a response.

Even after responding he might still be unable to get it.

23.
We often learn to respond to a stimulus without developing the capability of producing that stimulus as a response. We could learn to respond to "Alfa Romeo" without learning to produce "Alfa Romeo" as a response.
This tells you there is no such thing as a two-way S-R pair?
True - go to frame 24.
False - go to frame 25.

24.
You are wrong. The statement is not true, it is false. Two-way S-R pairs certainly do exist, and can be programmed. See frame 19 for an example, then return to frame 23, read it once again, and choose the correct answer.

25.
Yes, there really are two-way S-R connections, but only if taught both ways. Teaching an association only one way does not guarantee that the student will learn it in the other direction. To change your Alfa Romeo sequence from a one-way association to a two-way association, what would you have to add to the sequence you wrote?
*______________________________________
_______________________________________.

25)
We'd have to add a short sequence teaching "Alfa Romeo" as a response.

26.
The main point is; if an association between two words, terms, definitions, etc., is to be learned in both directions, then the program must teach it both ways, or the student is likely to remember it only the way he practiced it. He might be able to say "Mark Twain" as a response to "Samuel Clemens", but not be able to tell you Mark Twain's real name!

27.
This whole point might seem contrary to common sense, but try this: when you drive to a friend's house some distance away, you turn at all the appropriate corners, responding to street signs or landmarks as stimuli. Now think of the route to some friend's house. Concentrate on every corner where you must either go straight ahead, or turn left or right. Think about it for a minute.

28.
Now the test! Try to name every street sign or the name of every landmark at a corner where you turn (names of stores, churches, etc.). These are the stimuli that guide you, but can you name them as responses to this question? Probably not. If you can, this demonstration was a flop, but believe us, there are many cases in which you cannot name the stimuli.

29.
In that last example, the stimulus for a left turn at corner X might have been a street sign, a building at the corner, or almost anything else. You might invariably make the turn correctly, but be unable to tell me how many blocks to travel or what stimulus to look for. We all respond to stimuli of this sort, but often cannot name the stimuli to which we respond.

30.
Now at last we're ready to go back to the frame writing, but first you have to respond to all that reading matter in the last four or five frames. Take out the APPENDIX, open it to page 8, and for rule 6 write the rule we have been discussing, concerning two-way S-R connections. Refer to frame 26 for a statement of the rule, and to frames 27, 28, and 29, for additional explanation if necessary. Then put the APPENDIX away and go to frame 31.

31.
Do you have the sheet with the criterion frame on it? First we'll teach that examples like A = BC are called "multiplication examples". Then we'll turn the S and the R around and teach him that he is to write an example like X = YZ when we call for a multiplication example. First, think of two multiplication examples.

32.
Perhaps we could think of a cue frame for the word "multiplication", but instead let's use the other alternative and write a ______________frame. First, write down a mutliplication example.

32)
copy;
X = YZ (etc.).

33.
We'll write the copy frame: show the student a multiplication example, telling him what it is called and why. Show him a second example like the first and say it is called a blank example. If you understand what to do, skip to frame 35. If you want some additional help. go to frame 34.

34.
The first sentence should show an example, and say that it is called a multiplication example because it shows that A is equal to B multiplied by C (or whatever letters you use). Second sentence: to the effect that since G = RQ means G equals R multiplied by Q, this is also called a _________ example. Don't copy this wording. Write your own! Got it? Write the frame, then go to frame 35.

35.
Your frame might look something like this: This equation, A = BC, is called a multiplication example because it indicates that A is equal to B multiplied by C. X = YZ is another equation like A =BC, and it is also a multiplication example. (the underlined word is the blank). Do not change your frame if it appears to be adequate.

36.
You know that in the next frame you must have the student____________the same response. Write the next frame, and add to it the instruction that he is to use three new letters and write another example like the one that you used in the first sentence. Give him blanks like this:_______=____ ____ in which to write his example.

36)
practice.

37.
Your practice frame must begin by showing the student an equation and having him complete a sentence that says"..... is called a (blank) example. The next sentence tells him to use three new letters and write another equation like it. The second sentence should not contain the word "multiplication . Why not?*_______________________________
____________________________________.

37)
See the next frame.

38.
We don't want the word "multiplication" to appear in this frame because it is a practice frame, and the word to be practiced should not appear anywhere in the frame, or he can copy it again. If you used the word in your practice frame, revise the frame and remove the word "multiplication".

39.
Frame 1 - copy "multiplication".
Frame 2 - practice "multiplication".
In the next frame we'll use a cue frame for "division". First, think of one multiplication example, and one division example.

40.
This 3rd frame will be a combination frame; practice for "multiplication", and cue for "division". First you might show $A = BC$ and say that this is called a __blank__ example, and then show $A = \frac{G}{R}$ and say it is just the opposite, (or different) and it's called a __blank__ example. Now, use the two examples you thought of, and write a similar frame. Don't copy this wording.

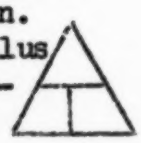
41.
Look over the frame you just wrote. The first part should contain a multiplication example (stimulus), and enough words to say it is called a (response) example. Check the frame, and fix it up if necessary.

42.
Next part; a division example, and the statement that it is the opposite of the first example and is called a __blank__ example. The strong cues for the response "division" are the words "multiplication" and the word________________, plus the student's previous knowledge of multiplication and division. Add one more sentence. Tell him to make up one example of each type.

42)
opposite. (most students, if asked for the opposite of multiplication, would say "division", even though a mathematician might not like that question).

43.
That was a combination of practice and cue and you also had him copy the format as an equation. Now let's write a practice frame for both responses he's learned so far. Use a multiplication example and call for "multiplication" as a response. Use a division example, but this time use two blanks and call for "division example". Tell him also to make up one more example of each type.

44.
Next frame. Show him this pyramid. Tell him it is called the M-D pyramid and that M-D stands for Multiplication-Division. Tell him to draw the pyramid. (Stimulus is M-D pyramid" plus word "draw". Response is drawing the pyramid.).

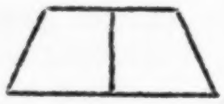


45.
The frame you just wrote was a copy frame. He copied the drawing of the M-D pyramid. So now you must write a *________________ __________________in which he must *________________________________

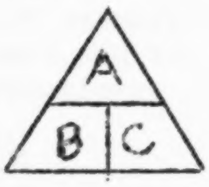
45)
practice frame; practice drawing the pyramid without copying it.

46.
Write your practice frame by simply telling him to draw the M-D pyramid again. Also, tell him to use the letters, E, F, and G, and write you a multiplication example. Don't forget to use blanks or arrows or something to show him where to draw the triangle, and where to write the example.

47.
Now you are ready to have him combine an example and part of the pyramid. Show him this part of the pyramid and tell him the bottom two blocks mean multiply. Tell him to look at the example he just wrote and to put the two letters on the right of the equal sign into these blocks.



48.
To be sure he understands, show him, A = BC and this pyramid. Give him an empty pyramid and a new multiplication example and have him put the three letters into the appropriate blocks.



49.
Now we'll do it a different way. Have two pyramids with a different multiplication example under each pyramid. In the pyramid on the left, you put the letter from the left side of the equal sign into the top space of the pyramid. Tell him to complete the first pyramid and then tell him to put the second example into the second pyramid.

50.
Notice that both this program and the one you are writing do not always involve words and statements; sometimes a program involves some kinds of tasks or performance. So far you have had your student perform two different nonverbal tasks. One of them involved
* ________________________________;
the other involved * ________________
________________________________.

50)
drawing the pyramid; putting letters into the blocks of the pyramid.

51.
You've had the student put multiplication examples into the M-D pyramid. Now work in the opposite direction. Show him a pyramid with three letters in it and show him the equation it represents.

52.
Wait a minute. You aren't finished with that frame. Give him another pyramid with three letters in it and ask him to write the equation that it represents. Don't give him separate blanks like this:_____=_____ ______, just give him a long blank.

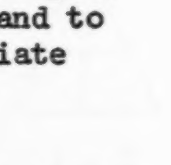
53.
Now for a practice with no help at all. Give him a pyramid with three letters in it and ask him to write the multiplication example it represents.

54.
Now a review in the opposite direction. Show him only a multiplication example. Tell him to draw an M-D pyramid and to put the letters into the appropriate blocks.

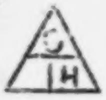
55.
In the next frame show him one division example, and ask him to make up two more like it.

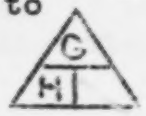
56.
In the next frame we'll identify a critical difference between the two kinds of examples. Say that one letter over another (show him what you mean - $\frac{A}{B}$) means divide. In the second sentence, say that while AB means ___blank___,
$\frac{A}{B}$ means ___blank___.

57.
Next frame. Show him this pyramid: Tell him that since the A is over the B, the pyramid indicates that A, the top letter, is to be ___blank___ by ___blank___, the ___blank___ letter. Remember to use your own words. Don't parrot these.

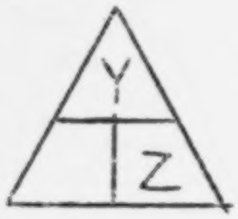


58.
That frame was, in effect, a cue frame. The practice frame will use these two stimulus examples, plus an explanation that they both mean that the blank letter is to be blank by the blank letter. Get it? Write the frame.

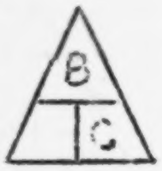




59.
In the next frame, show a division example, such as $X = \frac{Y}{Z}$, and a pyramid with the two letters from the right hand side of the equal sign in these two blocks. Say that both the example and the pyramid show the same thing, that the letter Y is to be long blank.



60.
Show this example, this pyramid, and another division example. Tell him to draw an M-D pyramid. Have him put the two right hand letters of the second division example into his pyramid. Tell him to check the first pyramid to see where to put each of the two letters.



$A = \frac{B}{C}$

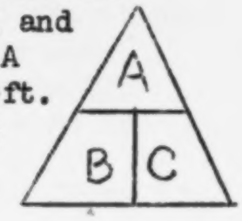
61.
In the next frame show a blank pyramid and a division example. Have him put the right hand letters into the pyramid. Then tell him to put the remaining letter into the other, empty block in the pyramid.

62.
Now you're ready to show him how to use the pyramid. In the next frame show him two blank pyramids, one multiplication example, and one division example. Have him put each of the examples into a pyramid.

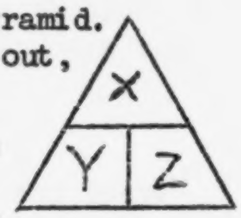
63.
Next frame give him two pyramids and these examples: $6 = 3 \times 2 \qquad 3 = \frac{6}{2}$

Tell him to put each example into a pyramid. In the same frame ask if both pyramids are now exactly alike. They should be!

64.
Now we've established a relationship between the two types of examples and the M-D pyramid. O.K., show him this pyramid. State that if you take out the B, then A over C is left; and that if you take out C, then A blank blank is left. Take out A, and blank is left. Remember, you should not use these words or sentences; write your own.



65.
Next frame. Show him this pyramid. point out that if Y is taken out, $\frac{X}{Z}$ is left, $Y = \frac{X}{Z}$ If Z is taken out, then blank is left, so Z = blank. Write the frame so it is perfectly clear to the student.



66.
Next frame. Put three letters into a pyramid. Show one of the division examples taken from it. Ask the student to take out the other division example and the multiplication example.

67.
Next, give him a multiplication example. Tell him to draw an M-D pyramid and put the letters into it. Tell him to write the two division examples represented by the pyramid.

68.
Next frame. Write a division example. Tell the student to draw a pyramid, put the letters into it, and write the other two equations.

69.
O.K., now add the criterion frame. You have it written down on your sheet of paper. Given those two examples, the student is to determine the remaining four examples.

PUT THESE FRAMES IN A SAFE PLACE. DO NOT LOSE THEM. LATER WE WILL DO SOME EDITING WORK TO REMOVE SOME DEFICIENCIES!

70.
That's it! You've completed a sequence of more than two dozen frames. Now, guess at this answer. What do you think you should do with the sequence now.
Try it on a student - go to frame 71.
Put it aside for a day or two - go to frame 72.
Edit and rewrite it now - go to frame 73.

71.
You want to try it out! No, not yet. It is in too rough a form and should not yet be shown to anyone! Go back to frame 70 and try again.

THIS IS A PERSONAL VIEW OF THIS PROGRAMMER, AND DOES NOT NECESSARILY REFLECT THE OPINION OF ANYONE ELSE!

72.
Put it aside for a day or two and leave it alone. That is the recommendation. While writing frames you get pretty involved, and your own train of thought will often fill in gaps and holes in the sequence. If you put it aside for awhile, your next look at it will be fresh and you will find weaknesses that weren't visible before. Skip to frame 74.

73.
Rewrite it. Eventually you will, but we recommend that you do not revise it just yet. Go back to frame 72 and see what we do suggest.

74.
Arrange these procedures in the proper order. Revise; write first draft; put away for a couple of days; try the program on one student; first edit.
1.______________________________.
2.______________________________.
3.______________________________.
4.______________________________.
5.______________________________.

74)
1. first draft.
2. put away.
3. first edit.
4. student tryout.
5. revise.

75.
And what are the first two things you do before writing frame sequences?
*______________________________
______________________________.
Do you remember why?*____________
____
______________________________.

75)
write the objectives, then the criterion frames.
It's a way to identify all the relevant responses.
(If you didn't remember, you might check back in Unit I, to Chapter 3, frames 37 - 41).

Go on to the Discussion.

DISCUSSION: FOLLOWING CHAPTER SIX.

Chapter six walked you through the development of a sequence of 27 frames. Don't worry now about errors or violations of our rules. We'll take care of those later when we will look it over closely, edit and revise it. (So be sure to save it!) You will also try your sequence on a student or two, and we will revise it again on the basis of student tryouts.

You wrote that sequence under very artificial conditions, since you had no set of visible objectives from which to work. You know that the program is to provide progressively less and less help as you do more and more on your own. This means that for this program to do its job, you must eventually produce a satisfactory program without further assistance from the program. You can guess, then, that the next sequence you write will be with a little less help from the program.

At this point we must introduce a new term. The term is "mediator", which means a go-between, or something that is interposed or inserted between two things. In this case, the other two "things" are a stimulus and a responss. A good example here is the case of someone asking you, "How many days in July?". You might be able to respond promptly, "Thirty-one." Many people, however, resort to the use of a mediator to answer that question. The mediator is well known: Thirty days hath September, April, June, and November...". Or you might look at a calendar. Both the calendar and the jingle are mediators. The calendar is an external mediator (external to the person) and the jingle is an internal mediator (memorized by the person). When a mediator is involved, we have, instead of S-R (stimulus followed by response), S-mediator-R, with the use of the mediator coming between stimulus and response.

There are many mediators you may have learned in school: "i" before "e" except after "c"; or, the colors of the spectrum are represented by the name Roy G. Biv (Red, Orange, Yellow, Green, Blue, Indigo, Violet), and many others. Some of these become unnecessary and are forgotten (after a while you spell "receive" without hesitation) while others remain. Some people refer, all their lives to, "Thirty days hath September" to remember the number of days in a certain month.

Some external mediators become so well learned that they become internal mediators, and can eventually become unnecessary. There are also many external mediators that are never internalized. A cook, for example, doesn't memorize all of her recipes. A statistician does not learn the contents of all his technical reference manuals.

Did you ever watch a group of beginning bridge players? They purchase small reference cards or special tablecloths that have bidding guides printed on them. Later, with experience and practice, a bridge player will learn to do without the cards or printed tablecloths. At this point he "automatically" adds 4 points for an ace, three points for a king, and so on. He might also have learned a rule that says, "Never lead from a king." This rule could become internalized so completely he no longer thinks of it, but the rule continues to control his leads to the extent that he never, never leads from a king! Another example of the same kind is the beginning poker player, who sits down to play bearing with him a card that says, "Three of a kind beats two pair; a straight beats three of a kind; a flush beats a straight, etc.". He refers often to this card, much to the disgust of the more seasoned players. Eventually the mediator will become an internal mediator, unless he finds the game too costly and buys oneof those bridge mediators instead.

Now answer each of these questions.

1. In simple form, how do we define a mediator?

2. What is the difference between an "internal mediator" and an "external mediator"?

Check back into the text material to see that your answers are adequate, then go on to Chapter Seven, which will teach you to use a mediator.

POST-TEST CHAPTER SIX.

1. How does a program make sure the student is learning, rather than just reading or hearing, the material?

2. What are the first two things you do when you start writing a program? Why?

3. What is the rule about 2-way S-R connections?

4. Arrange these procedures in the proper order: Revise; write first draft of frames; put it away for a couple of days; try the frames out on a student; first edit.

5. What is a "mediator"?

6. What is the difference between an "internal mediator" and an "external mediator"?

ANSWERS TO POST-TEST CHAPTER SIX.

Questions	Frame
1.	6 - 8
2.	9 - 11
3.	17 - 30
4.	70 - 74
5.	Discussion following Chapter Six.
6.	Discussion following Chapter Six.

PRE-TEST CHAPTER SEVEN.

1. You are about to begin a sequence by introducing a word. Which of the two information frames we have discussed should you attempt first?

2. If the word you want to introduce may be already a part of the student's vocabulary, but you can't find out for sure, how should you introduce the word?

3. Why do we say never capitalize or underline the word in a copy frame that is to be copied?

4. What would we call a diagram which would help you make the correct response to a stimulus? If you learned the diagram so well you could respond correctly by picturing it in your thoughts, what would you call it?

5. What is the difference between "overt" and "covert" responses? Why does a program ask the student for overt responses?

6. What kind of a sequence do we use in writing the first draft of a program?

7. List the three kinds of adaptive sequencing and describe the characteristics of each.

UNIT II CHAPTER SEVEN.

In this chapter you will learn more about mediators. The program will also teach you the use of a working diagram related to cue and copy frames. You will get extensive practice in the techniques of writing information frames in the next chapter, (a skill that is not quite as simple as it looks!) but for now just learn to use the diagram. Open the APPENDIX to page 11.

	1. This complex-looking diagram is really quite simple, and is based on a series of questions answered either Yes or No. Look at the very top of the diagram. Its title is *______________________ ____________________________________.
1) Preparation of cue or copy frames.	2. The diagram, as you can tell from a brief inspection, and from the title, outlines part of the procedure for writing *______________and*_____________.
2) cue frames; copy frames.	3. The procedure and sequence is shown to run down the page. You will notice that each block in the diagram is connected to the block below it by an ____________.
3) arrow.	4. When you read down from one block to the next, you follow one of the ___________ that has a solid line and points (up or down?) __________. You will also notice in the middle of the diagram, a vertical dotted line that points (up or down?)_________.
4) arrows; down; up.	5. Look at the very first question that you are to ask yourself. The question is *_____________________________________?

5)
Response part of student repertoire?

6.
Notice that this frame of this program seems to violate the rule of following every copy frame with a practice frame. Frame 5 was a copy frame. We don't have to follow it with a practice frame because here we are only directing your attention to certain parts of the diagram and want to be sure that you look at the appropriate part. We do not want you to memorize the content of the diagram; we just want you to learn to use it. Go on to the next frame.

7.
On the left side of the vertical dotted line you see that the diagram deals with __________frames, and on the right side of the line deals with *______________
________________________.

7)
cue; copy frames.

8.
Now look at the first question at the top of the page again. There are three possible answers to the question. The three choices are *__________________
__________________________________.

8)
yes, don't know, no.

9.
Suppose we're writing a math program for 10th graders. Suppose we want to use the word "logarithm" as a response. We can't do it unless they already know it, or unless we are going to teach it at this point. Do you think all of the 10th graders will already have this word in their repertoire?

Yes - go to frame 10.
Don't know - go to frame 11.
No - go to frame 12.

10.
You say "Yes", but that is a pretty dangerous supposition. If you assume that the response is already available, and build your program on that premise, any student who doesn't have the response in his repertoire could immediately become confused and be lost by the program. Return to frame 9 and choose a better answer.

11.
You don't know. Good answer. It is always better to say "don't know" than to say "yes" when you could be very wrong. If we say either "yes" or "no" when we really aren't sure, we are in danger of either underestimating or overestimating the student. Now skip to frame 13.

12.
You could be right, but unless you are absolutely sure, it is usually better to admit that you don't really know. Assume that you did admit that in this case and go back to frame 11.

13.
Of the two possibilities, which is worse, underestimating the prior knowledge of the student, or overestimating it?
Overestimating - go to frame 14.
Underestimating - go to frame 15.

14.
Right! Generally speaking, if we slightly underestimate the student, and go on and teach something that he has already learned, we'd be reviewing and little if any harm would be done. If we overestimate, however, we assume a capability that he does not have, and we neglect to teach something that needs to be taught. Go on to frame 16.

15.
No, it isn't really too bad to underestimate the student - within reason. If our estimate is too far off, of course, the program would waste a lot of the student's time. Go back to frame 14 for a discussion of the correct answer.

16.
The conclusion here is that if we don't really know whether or not a response is part of the student's repertoire, we should admit that we *______________, and if forced to choose between guessing either "yes it is" or "no it isn't", it is usually safer to say that the answer is (yes or no?)______________.

16) don't know; no.	17. Look at the diagram again. If the answer to the first question is "No", the arrow from the "No" block sends you to a block on the right that tells you to *________ ______________________________________.
17) write copy frame.	18. If the answer to the first question is "Don't know", the arrow from that block sends you to a block that asks you this question: "*__________________________ _________________________________?"
18) Can you test the students to find out?	19. If you cannot test the students to find out, the "No" block following this question sends you to the block labeled: "*_________________________________." If the answer is "Yes", you are told to go ahead and *_________________________.
19) Write copy frame; find out (the answer).	20. So, if possible, you find out the answer, removing the doubt. If the answer is "no", the arrow goes to "*_________________________________", as before.
20) Write copy frame.	21. If the answer is "yes" to this question or to the first diagram, the arrows take you to a block that tells you to try to think of an *______________________. This tells you that you are to try to write a _______________frame.
21) existing association; cue.	22. Suppose that you cannot think of an existing association! You answer "no" to the question that asks if you can, and the "No" arrow leads you to the block that tells you to write a *______________.
22) copy frame.	23. If you can think of an existing association the "Yes" arrow points to a block that tells you to go ahead and "*______ _________________________________.

23) write the frame.	24. So you write the frame, revising and rewriting until you think you have done the best you can with the association you picked. The last part of the block that tells you to write the frame then asks the question: *"____________________ ____________________?"
24) Does the frame appear to be adequate?	25. If your answer to this question is "Yes", the "Yes" block tells you that this frame is finished and you should *______________ in the program.
25) use it.	26. But, if you are dissatisfied with the frame in spite of your best efforts, your answer to the question of whether or not the frame is adequate would be "No". The "No" block sends you to a block that asks if you feel that you selected an appropriate *________________________________.
26) existing association.	27. Some associations just aren't very useful for writing cue frames. If your answer, however, is that the association appears to be O.K., the arrow sends you to a block that tells you that the * "__________ ____________________."
27) Frame must be rewritten.	28. From the block that says that the frame is to be rewritten, the arrow sends you back to the block that says:*"__________ ____________________."
28) Write (in this case, rewrite) the frame.	29. If you answer "No" when deciding on the adequacy of the association that you are trying to use, the "No" block sends you to a block that asks you to try to think of *______________________________.
29) another existing association.	30. Can you think of another existing association that might work? If you can, the "Yes" block sends you back to the block that tells you to *______________ ______________. If your answer is "No", that block sends you to the block that says:"*______________________."

30)
write the frame;
Write copy frame.

31.
Earlier you were told that when calling for a word, term, or other reponse for the first time in the program, you should use a _________frame if possible, otherwise, use a ________frame. This diagram follows that rule.

31)
cue; copy.

32.
We can't write a cue frame unless some sort of ________________already exists in the student's repertoire. This means that the ____________itself is already a part of the student's repertoire.

32)
association;
response.

33.
If there is an existing association, does this rule mean that we must absolutely use a cue frame at this point in the program? (Yes or no?)__________________.

33)
(see frame 34).

34.
No. You just saw in the diagram that if it is impossible to write an effective cue frame from the existing association, the arrows will send you to the "Copy frame" block. The rule recommends that you try to use a cue frame wherever possible. Sometimes, in spite of the existence of associations that include the desired response, it is just not possible to write an effective cue frame. Go on to frame 35.

35.
Now you have seen how the "Cue frame" portion of the diagram works. The right hand side of the diagram deals with the writing of *_________________________.

35)
copy frames.

36.
The block at the top of the "copy frame" portion includes the statement that there should be _________components to the copy frame. The first is "a________________
______________________________".

36) two; Key S plus relevant R.	37. The first component or part of the copy frame is to consist of the key stimulus (specific stimulus) plus relevant response, both S and R being shown to the student. The second component must consist of the :*__________________________ __________________________.
37) key stimulus plus a blank.	38. The next block provides a check on the way you wrote the frame. It asks whether the two components are ____________to each other.
38) similar (identical).	39. Do you remember the dull frames we talked about in Chapter 5? (The Alpha Romeo is a sportscar. Yes, the Alpha Romeo is a ______________.) You see how, in this extreme example, components that are too much alike result in a dull frame that requires no thought. If your answer was "yes", that the components are similar, the "Yes" block refers you to a block that reminds you that the components must be _____________from one another and refers you back to the first block so you can *____________________________.
39) different; rewrite the frame.	40. If the answer is "No", and the two components are adequately different from each other, you are referred to a block that asks "*__________________ ____________________________________.
40) Can student simply look for the word to be copied without carefully reading entire frame?	41. Let's take a minute or two to clarify the question you just copied. In a copy frame we want the student to __________the relevant _____________, but, more important, we want him to _________about what he is doing!

41) copy; response; think.	42. If, for example, the student spots a word that is capitalized or underlined, he might simply put that word into the blank, without reading the frame. That would be bad because we want him to _______about his responses. (In this case, what would be the stimulus for his response?*____________________ ____________________________________.)
42) think; The capitalization or underlining (the devices used to catch his attention).	43. In a copy frame we ______________(sometimes or never) capitalize or underline the word that is to be copied. We must "bury" the response in context and meaning so that the student *_____________ ________________________________.
43) never; must think about what he's doing (can't just copy the word without thinking).	44. Now look at the block again that contains that question. If your answer is "Yes", the arrow sendsyou back to *___________ ________________________________.
44) rewrite the frame (or back to the block that says "Write copy frame").	45. If the answer is "No", it is not possible to make the correct response without thinking, or at least without careful reading, you are referred to a block that asks one final check question: is the *__________________________present in __________ _________________?
45) key stimulus; both components.	46. So you would check over your frame. If the key stimulus is present in both components, you are told that the draft version of the frame is done and that you may now *_____________in the sequence.
46) use it.	47. If the key stimulus is not present in both components, you are told that the *______ ____________________, and you are then sent back to the frame that tells you to *________________________________.

47)
frame must be rewritten; rewrite.

48.
This diagram looked complex when you first saw it, but now that you have walked through each question and answer branch, it's quite simple. Look back over the entire diagram now, just to reassure yourself that it is all familiar. Now go on to frame 49.

49.
Of the seven dotted arrows that send you back to the "write copy frame" block, how many come from the "cue frame" side of the diagram?________________.

49)
four.

50.
What type of situation would have you follow an arrow from the "cue frame" portion over to the "copy frame" side of the diagram?*____________________
____
____________________________________.

50)
You would go from the cue to the copy frame side of the diagram if you started to write a cue frame and then found out that it could not be done.

51.
This diagram is designed to serve as a guide to help you write information frames. After a while you will get so proficient you will automatically follow these principles without needing to refer back to the diagram. You see that now the diagram is an "external ___________", and later it will become an "___________ _______________".

51)
mediator;
internal mediator.

52.
This word "____________" refers to something that comes between, to help the individual make the appropriate response. Given the problem, "Which kind of information frame do I write and how?", this diagram acts as a ___________. It helps you make the appropriate response, which in this case means it helps you to *______
_____________________________________.

52)
mediator;
mediator; write
the appropriate
kind of frame.

53.
Here's further clarification of the term "mediator" as it's used here. If you are asked what "gloze" means, and you have to look it up in a dictionary before you can respond with the definition, would the dictionary be considered a mediator?

Yes - go to frame 54.
No - go to frame 55.

54.
Yes, it would be a mediator, as we use the term here. Between the question (stimulus) and your answer (response), you had to refer to an external mediator. Any outside source that helps you give the correct response can be considered an external mediator--a book, a table of figures, diagram, map, etc. Now skip to frame 56.

55.
You are wrong. The dictionary would be considered an external mediator. Turn back to frame 54 to see why this would be the case.

56.
If you were asked to answer this problem, 63 X 754 = ?, you would not be able to respond as quickly as you could if the problem were 2 X 3 = ?. Is either of these problems part of an internalized or internal mediator?

No - go to frame 57.
Yes - go to frame 58.

57.
You don't think that 2 X 3 is part of any internal mediator! Granted, given 2 X 3 as a stimulus, you no longer need a mediator to quickly give the response, 6. However, you initially learned this S-R pair as part of a system, and probably used a little chart or table as an external mediator. See what we're leading up to? Go to frame 58 to find out what we mean.

58.
Of course! 2 X 3 is part of the multiplication tables we learned as children. But we din't learn it as far as 63 X 754. What other type of internal mediator is available for you to use that will help you answer the question 63 X 754 = ? *______________________________
______________________________.

58)
(see frame 59).

59.
Another internal mediator available to you is your ability to multiply "in your head" or on paper. A device, such as a table or other reference, can be a mediator, but so can a process. For example, here multiplication is a "mediating process". It comes between the S and the R in order to *__________
______________________________.

59)
help the student produce the correct response, etc.

60.
Now, in your own words, what is a mediator, or mediating process?
*______________________________
____
______________________________.

60)
Any external source of information that helps the student respond. If the same guide has been learned so that an outside source does not need to be consulted, we call it an internal mediator. (eg. a mnemonic such as "Thirty days hath September.....).

61.
Later you will make use of the diagram as you write information frames. It shouldn't be long before you can do without it, and follow all the steps automatically. In other words, the ______________mediator will become an *______________________________.

61)
external;
internal mediator.

DISCUSSION FOLLOWING CHAPTER SEVEN.

In a program we make the student respond actively by asking him to answer questions or complete sentences. An active response can be either overt (saying, writing, doing, etc.) or covert (thinking). The important requirement in learning is that some sort of active response is made. If a student reads a book without actively responding to the material as he reads, little learning will occur. Everyone has experienced the frustration of studying a text, only to realize that while his eyes scanned the material, he did not actually learn or develop any comprehension of the content at all. We do not think that an overt response is essential to learning; an active response, whether overt or covert, is the requirement. We call for overt responses in a program only to guarantee an active response occurs, since it is unlikely that the student can make the correct overt response without also making the correct covert response.

Before we go on to discuss adaptive sequencing, you should make a few active responses to the material you just read.

1) Name the two kinds of active responses and distinguish between them.

2) Is an overt response essential to learning? If not, why does the program require them of students?

Now that you have answered the questions, check your answers here. The two kinds of responses are overt and covert responses. A covert response consists of thinking, while an overt response is a visible activity such as writing, saying or performing. While an active response is necessary to learning, it does not need to be an overt response. Programs require overt responses in order to guarantee that an active response does occur. If we could be sure that the progaam and student interacted in such a way that the desired covert responses occurred, then we would not have to call for overt responses.

ADAPTIVE SEQUENCING.

You learned a little about the term "adaptive sequencing" in Unit I, and have encountered adaptive techniques throughout this program. Every time you were told to go to a frame other than the next one in the numerical sequence, the program was adapting its instructional sequence to you.

The use of adaptive sequencing can contribute significantly to the effectiveness of a program, but can easily be overdone or used inappropriately. We can use adaptive sequencing effectively to determine whether or not a student has achieved a given objective. If he has achieved the objective, adaptive sequencing sends him on to new material. If not, it assigns him to additional instructional material.

By "adaptive sequencing" we mean the inclusion, in a program, of any sort of variation from a "straight line" or "linear" sequence, that is, no deviation from a 1, 2, 3 order of frames. The purpose of the variation is to adjust the sequence to the different needs that individual students bring to the program.

Unfortunately, several terms that came into use early in the development of programmed instruction have become entrenched in the field in a way that limits their usefulness. Since two of these terms, "linear" and "branching", have become a part of the existing literature, and since we want to break away from the rather stifling limitations of past usage, we must at this point discuss these two terms, their nature, restrictions and value.

Basically, a linear program is a single-sequence program in which every student follows the same sequence of frames from beginning to end. He does not skip frames, re-do any frames, or in any way move forward or backward, except by moving forward following the standard number sequence. The earlier advocates of linear programs used constructed responses (filling in blanks, producing constructed or short essay answers), very short frames, and wrote programs that attempted to prevent the student from making errors as he responded to each frame. Branching programs, on the other hand, contained multiple-choice questions that asked the student to select the correct answer from the several choices offered in the frame. Also, branching programs had fairly long frames, a paragraph or so in length. There was little attempt to have the student practice correct responses, allowing him instead to make errors and then providing a corrective frame or sequence of frames (a branch) to correct the error.

The two terms have unhappily become a part of the programming language in their most complex form. To many people a linear program is assumed always to consist of constructed responses, small step frames, while a branching program is assumed to consist of large steps and multiple-choice questions with a corrective branch for each incorrect choice. These meanings are no longer particularly valid or useful. However, more restricted meanings of the two terms can be extremely useful to us.

Because you are going to learn to write programs that include some of the characteristics of both these and other kinds of programs, we will define linear and branching in a way that will be more helpful to us. The term "linear" will be used to refer only to a straight line sequence of frames. It will not imply anything about the kind of responses the student makes, the length of the frames, or any other characteristic. By this definition, a linear sequence does not include any form of adaptive sequencing, since variation in a sequence means it is no longer linear. The term, "branching" will refer merely to one type of adaptive sequencing. It is the type you have seen often in this program, characterized by a frame that requres an active response, then sends you to one of several possible frames, depending upon the response you made. In some cases a wrong answer sends you to a frame that tells you why your answer was wrong and then sends you back to answer the question again. In other cases the frame will tell you why you were wrong and then send you on to a frame that tells what the right answer should have been. A branching frame can be long or short, and can ask either a multiple-choice or essay question.

Now, before going any further, describe in your own words the characteristics of "linear programs", and of "branching programs", as these terms are widely used in programming literature.

Linear:

Branching:

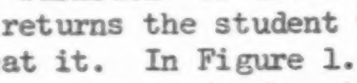
Now describe the very limited meanings we have given these two terms. Be precise, because these are the meanings that we will imply from this point on when we use the two terms.

Linear:

Branching:

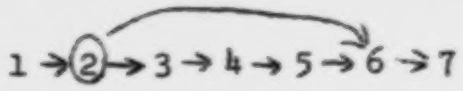
Let's see how these terms apply. When we first write a sequence of frames, we do not incorporate any adaptive sequencing. In other words, we write a linear program. Our analysis of objectives will tell us what form of response to call for in each frame as we proceed toward a criterion frame. We will generally want to write each frame in such a way that the student will be able to make the desired response. At certain points in this basic linear sequence - you will learn more about this procedure later - we will want to determine whether the student is ready to go on to a new objective or whether he needs further instruction on the current objective. At this point in the sequence we insert a criterion frame whose function is to diagnose or evaluate the student. If the student correctly answers the diagnostic frame, he is sent on to the new material for which he is prepared; if he cannot answer the diagnostic frame correctly, he is sent to frames that provide him with additional instruction on the same objective that he has been studying. The three basic procedures that are used to do this are: branching, bypass, and washback(washback is often called "re-cycle"). When "washback" is used an error in the diagnostic frame simply returns the student to an earlier part of the sequence to repeat it. In Figure 1., frame 4 is the diagnostic frame. An error sends the student back to frame 1.

Fig. 1.



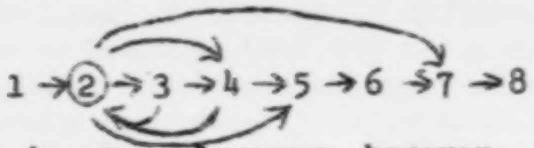
In a "bypass" arrangement a correct response to the diagnostic frame sends the student ahead, skipping some frames, while an error results in sending the student on through the frames that he otherwise could have skipped. In Figure 2, frame 2 is the diagnostic frame. An error sends the student to frame 3, while a correct response sends the student on to frame 6.

Fig. 2.



In a "branching" design, a "bypass" arrangement is used for the student who answers the diagnostic frame correctly, but the student who makes an error, instead of simply continuing on through the sequence, as in the case of the "bypass" procedure, can be sent to any frame or set of frames that his particular error requires. In Figure 3, frame 2 is the diagnostic frame. There are four possible answers. If he is correct he is sent to frame 7, and he bypasses frames 3 through 6.

Fig. 3.



Notice what happens in case of errors, however. One type of error sends the student to frame 3, where his error is explained and he is sent back to frame 2. Another error sends him to frame 4, and from there he goes to frame __________. Another kind of error sends him to frame 5, and from there he goes to frame ________ and then to frame __________.

A bypass design always moves in forward direction and usually involves only two alternatives - skipping an entire sequence or taking the entire sequence. A branching design allows a little more flexibility, and can consist of several alternatives, skipping one or more frames and sending the student forward or backward in the sequence.

For a test sequence at this point, we'll give you several incomplete sentences to fill in.

We always write the first draft of a program as a _________________ sequence, without including any of the three types of *______________________________, which are:
(1)________________________, which means that we *______
____
____;
and (2)________________________, which means that we
*____
____
____;
and (3)____________________, which means that we *________
____
____.

Check your answers by looking back to the text to be sure that you are correct, then open the APPENDIX to page 13 and write your three definitions into the appropriate spaces. Put the APPENDIX aside for a minute.

Why do we need adaptive sequencing at all? Why not write a single linear sequence or "track" that will be exactly right for every student? Well, we do recognize the existence of individual differences - differences in rate of learning, prior learning, ability to apply and generalize prior learning to new situations, and so on. To some extent, allowing each student to proceed through a program at his own rate reduces some of the effects of individual differences, but not all of them. A brighter student, or one who has previously learned many of the objectives of a program, often does not need as much guided practice or as many small steps as a much poorer learner. The use of adaptive sequencing lets us provide alternative routes through the program for students who have different needs, different abilities, and different learning backgrounds.

Now open the APPENDIX to page 13 again and copy the above question word for word in the space labeled "Question". Below the question write a detailed answer in your own words. Then go on to the next chapter.

CHAPTER SEVEN POST-TEST.

1. You are about to begin a sequence by introducing a word. Which of the two information frames we have discussed would you attempt first?

2. If the word you want to introduce may already be a part of the student's vocabulary, but you can't find if it is for sure, how should you introduce the word?

3. Why do we say never to capitalize or underline the word in a copy frame that is to be copied?

4. What would we call a diagram which would help you make the correct response to a stimulus? If you learned the diagram so well you could respond by picturing it in your head, what would you call it?

5. What is the difference between "overt" and "covert" responses? Why does a program ask the student for overt responses?

6. What kind of a sequence do we use in writing the first draft of a program?

7. List the three kinds of adaptive sequencing and describe the characteristics of each.

ANSWERS TO CHAPTER SEVEN POST-TEST.

Question	Answer
1.	Frames 31, 34.
2.	Frames 16 - 19.
3.	Frame 42.
4.	Frame 51.
5.	Discussion.
6.	Adaptive sequencing discussion.
7.	Adaptive sequencing discussion.

CHAPTER EIGHT PRE-TEST.

1. Describe a copy frame -- how many sentences has it and what is in each?

2. List the possible combinations of rules and examples in a copy frame under the RULEG system.

3. Describe the relationship, if any, between stimulus elements in a copy frame.

4. Where should the blank be in a copy frame?

5. Write a copy frame for this objective: (desired R underlined):
The Battle of Edgehill in 1642 began the English Civil War. (Royalists vs. Parliamentarians).

6. Write a combination frame to follow the Edgehill frame:
The Earl of Lindsey led the Royalists against the Parliamentarians.

7. The four types of existing associations used in cue frames are classification, opposites, obvious conclusion and related terms. Write one example frame for each of these types of associations.

UNIT II CHAPTER EIGHT

Normally you have to write the objectives before you can write the frames. We are going to take a seemingly backwards approach in this unit, and practice frame writing before you learn to specify your own objectives. This way, when you are learning to write objectives you will be able to see whether or not they are a good basis for frame writing.

1.
You have already learned several things about writing copy frames, For example, you know that the sentence with the blank into which the student copies the desired word must contain one very critical thing. What is it?*__________ ________________________________.

1)
The stimulus to which you want to "connect", "relate", or "associate" the response (or any similar indication that the stimulus is the important thing).

2.
As you practice writing copy and cue frames in this unit, you will find it helpful to use the Decision Flow Chart on page 11 of the APPENDIX. Turn to it now and keep it handy.

3.
To make it easy we will write every copy frame in the same basic way, consisting of two sentences. Obviously, the blank will be in the ____________sentence.

3)
second.

4.
The first two things we must put in place are: the word that is to be copied; and the blank into which the word is to be copied. The frame has two sentences. In the first sentence we put *__________ ______________________________, and in the second we put *_______________.

4) the word that is to be copied; the blank.	5. What else must be present, and must be put into both sentences? *________________________________ ________________________________.
5) the stimulus that we want the response to become associated with, so that from here on the stimulus will produce the response.	6. All right, now describe the frame as we have outlined it so far. *________________________________ ________________________________ ________________________________ ________________________________.
6) Two sentences, stimulus present in both. The desired response word in the first sentence and the blank in the second sentence.	7. But what do we use for "meat" in the frame? We use either statements or explanations of statements. A better way of saying this is to say that we use rules and examples. A general statement we will call a ________, and a clarifying explanation we will call an ______________.
7) rule; example.	8. Our two sentences we will write in the form of either ____________or _________. The first sentence of this frame is a (which?) ________________.
8) rule; example; rule (it is a general statement rather than an example).	9. "All matter consists of atoms. Salt, and water, for example, consist of ____blank____." Here is a standard form of a copy frame. The first sentence is a ________________, and the second is an _________________.
9) rule; example.	10. We can often remember things better if we organize them into a system. We'll discuss briefly the RULEG system. A short way of writing RULE-EXAMPLE is the word ________________.
10) RULEG.	11. A method of designing frames in terms of rules and examples is a system called the *_______________________.

11)
RULEG system.

12.
"All matter consists of atoms. Salt and water, for example, consist of ________________."
"Salt, water, and iron consist of atoms. All matter consists of ____blank______."

From the point of view of a RULEG description, what is the difference between these two frames?*________________
____
________________________________.

12)
1st frame: rule first followed by example.
2nd frame: example followed by rule.

13.
A copy frame can consist of ____________ followed by an ______________, or an ________________followed by a ________.

13)
rule; example;
example; rule.

14.
A copy frame could also consist of two different statements of the same_________ or could consist of two different ____________________.

14)
rule;
examples.

15.
"All matter consists of atoms. An important discovery in science was the discovery that all matter in the universe is composed of __blank__."
"Salt, water, and iron consist of atoms. Oxygen, mercury, and people consist of __blank__."
The first frame contains *____________
______________________, and the second contains *______________________________.

15)
1st: two statements of the same rule:
2nd: two different examples.

16.
In terms of rules and examples, a copy frame can contain four combinations:
*________________________________
____
____
________________________________.

16)
Rule, then eg.
Eg., then rule
Rule twice
Two egs.

17.
What else is in a copy frame? In both sentences we need the ______________. In the second sentence we need a _________.
In the first sentence we need the *______
________________________________.

17) stimulus; blank; word or term that is to be copied.	18. The stimulus can be in different form in the two sentences. "All matter consists of atoms." The stimulus is the word, "______________".
18) matter.	19. In the second sentence the word "matter" does not appear: "Salt, and water, for example, consist of _blank_." The stimulus in this sentence is made up of the words, "___________" and "_______", which are _______________ of matter.
19) salt; water; examples.	20. The stimulus does not have to be exactly the ________in both sentences, as long as they are synonymous, or one is an example of the other, or they are both members of the same class. In other words, it should be clear to the student that the stimulus in the first sentence is very closely ________________to the stimulus in the second sentence.
20) same; related (connected, similar, etc.).	21. Now put that into the form of a general principle: The stimulus in the two sentences does not have to be *_____________________________________, but does have to be *___________________________________.
21) identical in both sentences (or equivalent meaning); closely related in both sentences (very similar, connected, associated, etc.)	22. Open the APPENDIX to page 12. Number 2 is labeled, "Note concerning stimulus content of copy frames". In that space write the statement that you just completed in frame 21.
	23. In the first space on page 12 of the APPENDIX you see the words, "Content of copy frames". List here what must be included in the two sentences, but don't mention any RULEG considerations just yet. If you need some help, refer to frame 17.

24.
Now compare what you wrote with the points mentioned in frame 17 to be sure you didn't forget anything.

25.
On page 12 of the APPENDIX, number 3 says, "In terms of rules and examples, the four possible combinations that a frame can contain are :". In this space write the four combinations. Use frame 16 as a reference if necessary.

26.
One final statement that may seem obvious, but which programmers often violate is this: in a basic copy frame, the blank must always be in the _______ sentence. Or, if you happen to use one long sentence divided into two parts by a comma, the blank will always be in the *_______________________________.

26)
second (last);
second (or last)
part of the
sentence.

27.
On page 12 of the APPENDIX, in the space beside number 4, write in your words the statement that you just completed in frame 26. Put the APPENDIX aside, but keep it handy so you can refer to these statements on page 12, and to the flow chart on page 11. Now it's frame writing time.

28.
You now have a usable guide and should be able to turn out copy frames for the statements below without much trouble. Write the statements down, then we will walk you through a series of hints. The desired responses are underlined. Use scratch paper.

A hydrogen bomb is a thermonuclear device.
The battle of the Alamo was fought in 1836.

29.
The bomb example. It's difficult to think of examples, isn't it? So we'll use two different statements of the rule or fact. For the first sentence we can use the one you have already written down, but without the underlining. How can we vary the stimulus? One possibility is to change it to, "H-bomb", but we also have to change the sentence structure a bit. Go ahead and write a second sentence, and use two blanks for the two-word response.

30.
The simplest thing to say would be, "The technical name for the H-bomb is ________ ___________". Don't forget to make the blanks long enough for the responses, but don't try to make them exactly the same number of spaces as there are letters in the words.

31.
Now for the Alamo example. Use the first sentence as is, but without underlining. Now how about an example here? Can you think of any name that is usually associated with the Alamo - the name of a person? Who?____________________________.

31)
Davy Crockett, Jim Bowie, William B. Travis are names you might have known, particularly Crockett.

32.
The response you want is the date, 1836. Use Crockett's name and write the second sentence.

33.
You might have written, "Davy Crockett was one of the men killed defending it (or, the Alamo) in the year __________". Here's a fine point. Suppose the sentence ended with the words ".......
in ___ blank ___". The student might say, Texas, or, San Antonio! So we add the words "in the year" to prevent those undesired words from being used.

34.
Here are a few more to work on.

A program consists of a sequence of small steps.

A binary number system uses only two numbers, 0 and 1.

Stock represents part ownership in a company, while a bond represents only money loaned to the company.

Write the frames before going on.

35.
Before going any further, look at the copy frame portion of the flow chart on page 11 of the APPENDIX, and check also the statements on page 12. Revise your frames if you think you can improve them, or if you forgot to include something.

36.
Now check your frames. Did you remember to remove the underlining when you used the sentences we gave you? If not, do so. We never underline a word that is to be copied.

37.
Does the second sentence in each frame contain the same or a similar stimulus? If not, the frame is defective and must be rewritten. Correct this error if necessary.

38.
You could have used any of the four RULEG combinations. Which did you use for each frame?

1.__________________________________.
2.__________________________________.
3.__________________________________.

38) If you used the sentences we gave you as the first sentence in each of the frames, you used a rule first, so the only possibilities are rule-eg, and rule-rule.	39. For the first frame you could have used an example, like this: "Every frame in this program is an example of a blank blank .", or restated the rule, like this: "Every frame in a program is considered to be one very blank blank ." Underline the stimulus in each of these samples.
39) the stimulus in both samples is the word "program", and the word "frame" has been added to the stimulus, making it a slightly more complex stimulus.	40. For the second example, you might have varied the rule like this: "Although our decimal system uses zero and the digits 1 through 9, a binary system uses only blank different symbols." Or you could have written, "A BIcycle has blank wheels, and a BInary number system has only blank symbols". Underline the stimulus in each sample.
40) In both samples, the stimulus was identical with the stimulus in the first sentence: the word "binary". In the second sample we directed attention to the prefix, "BI".	41. In the third frame you probably said something to the effect that if you buy a bond, you are making a blank of some money to the company. In that case too, the stimulus in the second sentence was probably identical with the stimulus in the first sentence. Let's go on to some practice where you can modify the stimulus in the second sentence.
	42. Try these statements: American cars generally have the engine in the front. Many foreign cars have the engine in the rear. (If you want to name some cars here, you might mention Volkswagon, Renault, or Fiat). Write the frames, varying the stimulus in the second sentence.

43.
That should have been very simple. In the second sentence you simply name a couple cars that fit the label (American cars in the first frame, foreign cars in the second frame), and that's it! Ford and Mercury, for example, have their engines in the ___blank___ (careful here, don't say Chevrolet, because one model has a rear engine!). The same pattern would also work for the second frame.

44.
Now, in the APPENDIX on page 12, beside number 5, write all the examples of copy frames that you just developed. Also, at the top of the set of sample copy frames, write, "Sample copy frames".

45.
Time to write some practice frames. The simplest practice frame consists of only ___________ sentence, containing one ___________ in which the student is to write his ___________, and containing also, the appropriate ___________.

45)
one;
blank;
response;
stimulus.

46.
The one sentence can be either a ________ or an ___________.

46)
rule or example.

47.
The sentence can be either a rule or an example. It must contain some variation-some addition to, or modification of the stimulus. Following your "binary" copy frame, the practice frame should not say simply, "A binary system uses only ___blank___ symbols". Why not?
* ______________________________
______________________________.

47)
No variation (no addition or any sort of change) in the form of the stimulus.

48.
Here is a practice frame with some minor variation in the stimulus: Using a binary number system we can represent every number that we can represent in our decimal system, even though the binary system uses only ___blank___ different symbols. Would you call this an example, or a variation of the rule? ___________.

48)
Rule variation.

49.
Now, write a practice frame to follow your "bond" copy frame. The sentence can be either a rule or an example. Be sure to change the total stimulus content that goes with the key stimulus word "bond".

50.
A simple example might be, "If you buy a General Products Company bond, you are ___blank___ money to the Company". Notice that this sample makes the student change from the noun "loan", to the verb, which is the word "lending". Would it be just as appropriate to call for the word "loan" as the response?__________

50)
Yes, of course. In fact, in most cases it is better to call for the same word rather than a variation of it!

51.
We'll do more practice frames later. Let's move on to combination frames. We'll use the Alamo frame for this one. First of all, what response must be practiced in the practice part of the combination frame?______________.

51)
1836.

52.
Why must the student practice "1836"? And why couldn't we have him practice the word "Alamo" or "Crockett"? Don't write anything yet, however, Think of the question. Can you answer it correctly?

Yes - go to frame 55.
No - go to frame 53.

53.
Glad to see that you are willing to admit you need some help, but sorry you have forgotten something you learned earlier. First of all, was "Alamo" or "Crockett" called for as a response in your copy frame?________________.

53)
No, not if you followed instructions.

54.
What was the only response that the student made in the copy frame?________. So, according to a rule you learned in an earlier unit, what is the only response that we can expect him to be able to practice without difficulty?__________. Now you should be able to answer the question; go on to frame 55.

55.
All right. Now write your answer to that question we asked in frame 52.
*____.
____.
____.

55)
A practice frame can only call for a response that has previously been taught in either a cue or copy frame. "1836" is the only response that we can call for according to this rule.

56.
So the response to be practiced is the date 1836, and the stimulus is the word "Alamo" plus addditional words to indicate that the response is a date. Remember, however, that we want the stimulus to be slightly ________________ than it was in the copy frame.

56)
different (it should be basically the same stimulus, but with some changes or variations in wording and content).

57.
In this combination frame we also want to include a copy frame portion for the response "Santa Anna". What stimulus goes with this response? Hint: in other words, who was he?
*____.

57)
Mexican President and commanding general of the troops that won the battle of the Alamo.

58.
There are many ways to write this frame. The easiest way is think of it as being basically a copy frame. This means it will consist of two ____________.

58)
sentences.

59.
In the first sentence the words "Santa Anna" must appear, while in the second sentence *______________________________
____.

59)
we put the blank (or blanks) in which the student is to copy the name.

60.
It is often easier to write the second sentence first. Let's do that. The blank is for the name"________ ________". The stimulus in this second sentence will be something along the line of *__________
____.

60)
Santa Anna; Mexican General at the Alamo (or something like this).

61.
The second sentence might look like this: The Mexican commander at the Alamo was __blank__ __blank__. Now, write a second sentence of your own. Don't copy this one.

62.
Now we need that first sentence. It must contain the stimulus and blank for the response that is to be practiced, and must also contain *____.

62)
the name Santa Anna, the stimulus for that name (Don't forget the stimulus!).

63.
Now you know what must go into the first sentence. Go ahead and write it.

64.
The entire frame might read: Santa Anna, the Mexican President, personally led the Mexican troops at the Alamo in the year __blank__. The Mexican commander was named __blank__ __blank__. Underline the stimulus in each sentence for the response "Santa Anna".

64)
Sort of complex isn't it? Frame 65 shows approximately the words you should have underlined.

65.
Notice the broad form of the stimulus information! Santa Anna, the Mexican President, personally led the Mexican troops at the Alamo in the year 1836. The Mexican commander was named Santa Anna. You probably had trouble deciding about "Mexican President, personally". Read the sentence leaving out those words. Are they necessary?__________. Why?*____.

65)
No. Because the stimulus is perfectly clear and complete and varied even without those words (or any similar statement).

66.
There is an important rule demonstrated here, pertaining to combination frames. Each part of a combination frame is to perform the function of either a ________ frame, a ________ frame, or a ____________ frame.

66)
copy;
cue;
practice.

67.
In the APPENDIX, page 12, number 1, you wrote that a copy frame has how many components? ____________. If a combination frame is partly a copy frame, how many of these components must be present in the combination frame?
* ________________________________.

67)
all of them.

68.
In a combination frame, all of the components of the copy, cue, and practice that make up the combination must be present, although one stimulus might be the stimulus for both a practice and a copy. On page 12 of the APPENDIX, beside number 6, write this rule.

69.
Let's be sure you understand the rule. Beside it in the APPENDIX write your Alamo combination frame. Draw a circle around each of the parts of the practice frame and label them (stimulus, response), and do the same for each part of the copy frame (stimulus in both sentences, word to be copied, and the blank for the copied word). Add enough explanation to the rule and sample frame so later you will be able to use that information to remind yourself of these requirements.

70.
One last point on combination frames that you might want to add to your notes: since a combination frame is usually a combination of practice plus either cue or copy, you will find it easier to write the cue or copy component, as we did with the Alamo combination frame. Add this comment to number 6 on page 12 of the APPENDIX.

71.
Cue frames, you have learned previously, make use of *__________________________
to teach *___________________________.
The first thing we do is decide on the
______________ we want the student to make, and on the nature of the ___________ that is to be associated with it.

71)
existing associations; new associations; response; stimulus.

72.
There are many kinds of existing associations that we can use in cue frames. Classifications, for example, "Tuna, trout, bass and Neon Tetras are all ___blank______". The student is able to make the response because the existing association is based on a well-known _________________________of names.

72)
classification.

73.
On page 10 of the APPENDIX you will find the title "Types of Existing Associations Used in Cue Frames." Beside number 1 write the name you just learned in frame 72 and put the sample frame beside the word.

74.
Chapter One, Unit I, was a short introduction that described programmed instruction. Take it out now and we'll use some of those frames as samples of types of cuing. In Chapter One turn to frame 21. Can you guess what kind of existing association we call this?
_________________________.

74)
See frame 75.

75.
The cuing is based on opposite meanings. "....wasn't difficult, it was _blank____". Beside number 2 on page 10 of the APPENDIX write "Opposite meanings", and beside it copy frame 21 of the Introduction. Now find frame 25 of the Introduction. This is another example of opposites. Copy it beside the first example.

76.
Another type of cuing based on an existing association we'll call, "obvious conclusion". Write this down beside number 3. Now read frame 30 of Chapter One. In the first sentence the obvious conclusion is that information about correctness would tell him whether he is ____________or ______________. In the second sentence the conclusion is that in a good program he'll be __________. Copy frame 30 beside "obvious conclusion".

76)
right or wrong;
right.

77.
A type of cuing similar to "obvious conclusion" is "related terms". Read frame 2 of Chapter One. The second response is the word ________. The sentence structure indicates that the program teaches, so the student can easily see that the desired response is the related word learn. Beside number 4 write "related terms", and copy frame 2 beside it.

77)
learn.

78.
Frame 36 of the Introduction contains other examples of "related terms". Frame 35 has had the student respond with a statement about rate or speed, and the first two blanks in frame 36 require that he use two more "speed words" - fast, and slow. The next response is the word ________________, which is cued by the word "slow" and the words "can take a lot of". Copy frame 36 beside the other frame in number 4.

78)
time.

79.
Practice time. You are to write one more example of each of the types of cue frames you just wrote on page 10 in the APPENDIX. Take your time and use care. You have samples from which to work, and you can use the cue frame portion of the flow chart on page 11 of the APPENDIX. Write your frames and then return to frame 80.

80.
Obviously we can't show you correct or preferred versions of what your frames should look like. It is up to you to decide at this point whether they are adequate. You can do this: check your frames to see if the response is clearly called for by the stimulus part of the existing association. Also, check to see that the new stimulus is present - the one to which we want the response to become connected. If not, revise the frames.

81.
One other thing you can do is test your cue frames. Ask a friend to read them and see if he can easily produce the desired responses. If not they have to be revised.

82.
One final thing before we finish this unit. At the bottom of page 12 of the APPENDIX, number 7 is still blank. In that space write a rule in your own words to the effect that before you write any frame you always decide first what response you want the student to make, and next, to what stimulus you want that response to be connected. Write the statement of the rule.

This is the end of Chapter Eight.

Go on to the discussion.

DISCUSSION: FOLLOWING CHAPTER EIGHT.

What is the value of RULEG in teaching concepts? You have already learned it will help you determine frame content. More important, it is a way to present a principle in several frames, with a number of examples, so that the student responds to the concept in a range of applications. It is vital that the student learn to respond to and apply a principle in a general way rather than learn only a few limited examples. A beginning student, one who has not yet mastered a subject, will often be able to define or explain a principle only by saying, "Well, that's when such and such happens", - he gives an example rather than a general statement of the principle itself.

Here's where the RULEG concept can be of assistance to you. If you follow a process of systematically using both examples and the rule (the principle), and have the student respond to both varied examples and varied statements of the rule, you can maximize the probability of effectively teaching broad generalizations and concept learning.

Variation in stimulus form and content and in response form and content are essential in all programs, regardless of the nature of the objectives. RULEG is a reminder that you must systematically provide the necessary variety in both rules and examples when you program principles and concepts.

Question:

(1) Why is variation of form and content of both stimulus and response necessary when programming principles and concepts?

(2) What is the value of the RULEG concept in programming principles and generalizations?

Your answer to question (1) should indicate that such variety is necessary so that the student will learn to respond to and apply a principle in a general way -- so that he will "grasp the concept" (to use non-behavioral terms) rather than only be able to cite examples. RULEG's value (question 2) is as a reminder to insure the necessary variety of presentation, and to suggest meaningful content for your frames.

You learned in Chapter Eight that there are at least four different possible combinations of rules and examples that can be used in a frame. By adding one more rule or example to one of these two part frames, you can multiply the number of combinations possible.

Although there are a number of ways to combine rules and examples in frames, there are only two basic approaches to the teaching of principles using the RULEG concept. The rules-to-examples approach is still called RULEG, while the examples-to-rules approach is EGRUL.

The RULEG system teaches deductively. The student is given a rule followed by a series of clarifying examples to which he must respond, that is, complete, identify as correct examples, etc. The EGRUL system, teaching inductively, gives the student several examples for which the student must develop a rule.

Neither system is preferred over the other. Both RULEG and EGRUL sequences can be used in the same program. Which you choose depends on your objectives and subject matter. With some subjects, the student would have to see a dozen examples before he could state a simple rule. In that case, the RULEG approach would be better. With another subject, a rule could be awkward to state, but simple to grasp and apply, then the inductive EGRUL approach would be better.

Question:
Name and describe briefly the two possible approaches to teaching concepts using rules and examples.

Go on to the Middle of the Program Review, after completing Chapter Eight Post Test.

CHAPTER EIGHT POST-TEST.

1. Describe a model copy frame -- how many sentences has it and what is in each?

2. List the possible combinations of rules and examples in a copy frame under the RULEG system.

3. Describe the relationship, if any, between the stimulus elements in a copy frame.

4. Where should the blank be in a copy frame?

5. Write a copy frame for this objective: (desired R underlined)
The Battle of Edgehill in 1642 began the English Civil War. (Royalists vs. Parliamentarians.)

6. Write a combination frame to follow the Edgehill frame above:
The Earl of Lindsey led the Royalists against the Parliamentarians.

7. The four types of existing associations used in cue frames are classifications, opposites, obvious conclusion, and related terms.
Write one example frame for each of these types of associations.

8. Describe briefly the RULEG and EGRUL approaches to teaching concepts.

9. What is the value of these two approaches in frame writing?

ANSWERS TO CHAPTER EIGHT POST-TEST.

Question	Answers
1.	Frames 4 - 6.
2.	Frame 16 (13 - 16).
3.	Frame 20 - 21.
4.	Frame 26.
5.	Your copy frame must contain two sentences or parts. The first sentence consists of a stimulus (such as Edgehill, battle, etc.) and the response to be learned, 1642. The second sentence contains a variation of the same stimulus as the first one obviously related to it, and the blank. Be sure you indicated that the response was a year or date.
6.	The combination frame here should begin with an opportunity to practice the response made in the previous frame. This practice element should contain a stimulus like that of the previous frame (Edgehill, battle, war, etc.) an indication that the response is a date, and, of course, a blank. Parts two and three of the combination frame are the two sections of a copy frame: 1) new stimulus and response to be learned (Royalist). 2) similar stimulus and blank.
7.	
Classification:	Frame 72. Check list for your frame stimulus among others of its class and "they are all __blank____".

7. (continued)

Opposites:	Frame 75. Stimulus and not (avoid opposite of response) but blank.
Obvious conclusion:	Frame 76. Stimulus and obvious bit of logic that lead directly to the response.
Related terms:	Frame 77. Stimulus and word related to desired response by habit.
8.	Discussion.
9.	Discussion.

MIDDLE OF THE PROGRAM REVIEW

	1. The characteristic of programmed instruction that facilitates learning is its *________________________ presentation.
1) controlled small step.	2. To each small step the student must *________________________________.
2) make an active response (respond actively).	3. Overt active responses consist of *________________________________, while covert responses are *________________________________.
3) observable activity, (talking, writing, etc.); thinking responses, (thoughts which are not observable).	4. A program requires ________(what kind) active responses because *________________________________
4) overt; there's no other way to be sure an active response occurs (you can't tell whether a covert response occurs.).	5. Immediately after the student makes his response the program *________________________________.
5) confirms his response (tells him whether he's right or wrong).	6. To be sure the student remembers the responses he learns, the program *________________________________.
6) provides opportunity for controlled practice (gives him practice).	7. To be sure a program accomplishes its objectives, before it is published for the public it is *________________________________.
7) tested, revised and retested until it accomplishes its goals.	8. A program is first written in a straight line, or ______________ sequence, but to meet the varying needs of its students a technique called *____________________ is often used.

8)
linear;
adaptive
sequencing.

9.
Name and describe the characteristics of the three kinds of adaptive sequencing.
*______________________________________
____
____
____
______________________________________.

9)
Check your answer with the discussion following chapter seven.

10.
What is the difference between "specific" and "general" terms in a response?
*______________________________________
____
______________________________________.

10)
Specific terms are those for which only an exact synonym is an acceptable substitute. General terms may be expressed in a number of ways.

11.
How must a specific term be taught? (Describe fully your approach and the types of frames you'll use.) *____________________
____
____
____
____
______________________________________.

11)
Cue or copy frame followed by a practice frame. If there is an existing association, try a cue frame, if not use a copy frame.

12.
Before you begin to write a frame, you must decide *______________________________.
Why? *________________________________
____
______________________________________.

12)
what the response will be; to be sure that the response will be relevant.

13.
What are the first two things you do when beginning to write a program? *__________
______________________________________.
Why? *________________________________
______________________________________.

13)
(1) Write broad statements of objectives, (2) Write criterion frames;
So all responses will be relevant to the objectives.

14.
Now you may go on to the narrative review for Unit II at the end of the program. After the narrative review, begin Unit III.

INTRODUCTION TO UNIT III

Preparing the program's objectives for frame writing is probably your most important (and time consuming) task. In Unit III you will learn how to state your objectives in behavioral terms, write a criterion test, write a narrative description of your program, prepare a table of stimulus-response pairs, and set up your teaching sequence.

And, of course, besides learning about the five steps mentioned above, you will also write your own preparatory documents with guidance from the program.

CHAPTER NINE PRE-TEST.

1. What kind of test measures every objective of the lesson?

2. What kind of test samples the lesson's objectives?

3. All of these pre-test questions are criterion test items. State the objectives of this program for which question 2 above is a test item.

4. What are the two characteristics of a discrimination question?

5. Define "constructed verbal response".

6. Which of these are performance criterion test items: (more than one may be correct)
   a. building a dog house.
   b. writing lecture notes.
   c. demonstrating proper diving form.
   d. taking a test on driving rules.
   e. writing an information frame.
   f. writing a program.

7. How should you teach an objective, regardless of the response type label you put on it?

UNIT III

CHAPTER NINE

SPECIFICATIONS OF OBJECTIVES, or,

DESIRED LEARNING OUTCOMES, or,

IDENTIFYING TERMINAL BEHAVIOR, or,

STATING PROFICIENCY COMPONENTS.

So far you have not had the problem of deciding what content to put into the frames you have written, what response to call for, or what stimulus to use. All of that has been spelled out for you. Unfortunately, your objectives will not always be laid out for you. Even in a well-organized textbook or lesson plan the specific objectives are rarely as visible as they need to be for a programmer.

You are about to begin the specification of precise behavioral objectives for programming purposes. It is a unique activity, a bit different from any other way of arranging subject matter for instructional purposes. Ordinarily, when writing a textbook, the writer prepares the content, form of presentation, sequencing, illustrations and examples, and puts it all together into a form that seems most likely to allow effective communication between author and student. You'll remember that a program can be described as consisting of carefully sequenced small steps and controlled practice. Each sequence of small steps is systematically written for a single objective, and includes controlled practice of the desired terminal behavior in the absence of all appropriate stimuli. In other words, a program helps the student to practice what he is to learn, while a conventional textbook leaves it for the student to decide how and what to practice as he reads.

You may think it peculiar that, although the first thing you do when beginning to write a program is to develop your objectives, you are not learning to write objectives until now. It was important that you have enough experience to be able to see the necessity for detailed objectives written in a useable way.

1.
When writing an objective about evolution, we would not say that our objective is to have the student know that evolution refers to change. How would you change the underlined word in the preceding sentence to have it refer to a behavioral objective? Eliminate the word "know" and substitute ____________________.

1) ~~You could have said either "evidence of understanding", or "written essay"~~. say, state, explain, etc.	2. What is the student to be able to say about evolution? The answer to that question is a statement of an _______________. In fact, a very practical way to begin is to prepare a test consisting of a large number of _______________ and identifying all of the correct and adequate _______________. Good
2) objective; questions; answers.	3. We can begin our identification of the objectives to be programmed by writing a __________ containing all of the __________ that the student should be able to __________ after he has completed the program.
3) test (examination); questions; answer.	4. A test of this sort we call a criterion test. In the program the objectives are very visible in the __________ frames, and after completing the program the student will have an opportunity to practice them again when he takes the *_______________.
4) criterion frames; criterion test.	5. We test both the student and the effectiveness of our program when we have the student take the *_______________. A low score indicates that the _______________ has failed.
Some students can't 5) criterion test; did you say "student", or "program" in the second blank. See frame 6.	6. A low score indicates that the program has failed, except in the case of a student who didn't actually use the program, or a student unlike those for whom the program was prepared. If the students try, then the responsibility for effective learning is up to *_______________.
6) the program is responsible for producing learning of the objectives.	7. Let's make a distinction between a criterion test and an achievement test. A test that measures every objective is called a __________ test, while a test that only samples the objectives is called an _______________ test.

7) criterion; achievement.	8. Which of these tests samples the objectives of a course of instruction? a. Criterion test. b. Achievement test. Choices: (check one) a.___, b.___, Neither___, Both___
8) b.	9. Which of these can tell us exactly how effectively we taught each objective? a. Criterion test. b. Achievement test. Choices: a.___, b.___,Neither___, Both___
9) a. (an achievement test cannot tell us about each objective because it is almost always a sampling test that measures only a few objectives.)	10. Learning depends on: a. the student. b. the program. Choices: a.___,b.___, Neither___, Both___
10) BOTH. See frame 11. How can you argue with a program?	11. We hope you didn't say just the program is important! We said earlier that the program is responsible if the student goes through it as he should. A student who doesn't think as he reads our frames, won't learn! He can't think of other, distracting things (we call this "performing competing covert responses"). If you got that last frame wrong, you were not thinking. You should have been ready to argue with the program if we had tried to tell you that learning depends only on the program and not on the student!
	12. Learning depends on both the student and the program, but given a cooperative student, the program is responsible for teaching him the objectives. O.K., now let's get back to our objective; a criterion test is one that (samples the objectives, or, measures all of the objectives?)*________________________.

12)
measures all of the objectives.

13.
A criterion test includes at least one question for each ______________of the program. If a program contains 600 different objectives, the criterion test will include*_______________________________________.

13)
objective;
at least 600 questions.

14.
Consider the sequence you wrote about the M-D pyramid. The one primary objective was:*_______________________________________.

14)
See frame 15.

15.
~~Remember Mager's principles!~~ All we want you to say here is something to the effect that the student is to be able to rewrite equations like A = BC, or X = Y/Z, by solving for the other letters anything that tells what the student must do. An objective always must describe what the student ________.

15)
what the student does.

16.
"The student must understand the proper use of the M-D pyramid". "He must understand how to use the M-D pyramid to solve equations like A = BC or X = $\frac{Y}{Z}$ for the other unknowns." Rewrite these sentences into a usable objective.
*_______________________________________
____
_______________________________________.

16)
The student must be able to use the M-D pyramid to solve equations like A=BC and X=Y/Z for the other unknowns.

17.
The change is very slight, isn't it? We simply substitute "be able to use" for "understand how to use". The emphasis when we write objectives must be in writing statements that indicate
*_______________________________________.

17)
what the student must do (or, be able to do, or, perform, etc.).

18.
Rewrite this into a usable objective: "Student must know what a Neon Tetra is." (HINT: The objective should also include a statement of what the student is to "know" about a Neon Tetra).
*_______________________________________
____
_______________________________________.

18)
Student should be able to state that a Neon Tetra is a small fish that lives in the Amazon River.

19.
See, it is not enough to say, "Student should be able to describe a Neon Tetra". What description is wanted? The biologist might describe it by adding that a Neon Tetra, proper name hyphessobrycon Innissi, is a characin. And could add that it is blue with a reflective red stripe. But we don't want all that! A stated objective should tell us exactly*______________________________
____
____.

19)
what the student is to learn to say and do (answering a question is a kind of doing).

20.
Remember that rule you learned about introducing unfamiliar new words? How do you think that objective was described in the list of objectives for this program? Write it here:*__________
____
____
____.

20)
Student will state that the rule for introducing unfamiliar new words is; word must first be introduced in a copy frame in which the word can be copied. The word is practiced in the next frame, which is a practice frame in which the student cannot copy.

21.
Are there any words in that statement that we want to be sure that the student can define or explain? If so, what are they?*______________________________
____.

21)
Yes there are. See frame 22.

22.
A student could have memorized the rule without having learned any meaningful associations. There are two terms in that rule that were new to you when you began to learn the rule. What are the new terms in the rule that we must be sure the student has learned?*__________
____
____.

22)
Copy frame;
Practice frame.

23.
If a student cannot define both terms shown to the left of this frame, he has not added to his repertoire what we wanted him to learn. In our criterion test, how many questions would we need in order to test this complete objective?

1 - go to frame 24.
2 - go to frame 25.
3 - go to frame 26.

24.
Your answer, one question, is wrong, unless you are thinking of one question with more than one part to it. Consider each question to have only one part, in which case 1 is incorrect. Return to frame 23.

25.
Two was your answer, but that is not correct. You wrote a question for each term but you forgot that we also want the student to be able to state the rule, using both terms. Go on to frame 26

26.
Three is the correct answer; one part for each definition and one for the rule itself. But wait a minute! Is our objective complete? Is that all we wanted you to learn? Think about it for a minute, and then state why our objective requires more than just those three questions. *______________________________

____

____.

26)
If you looked ahead to see what the answer is because you can't answer the question, go on to frame 27, but if you answered the question and feel that you are correct, go on and skip to frame 29.

27.
You read the statement to the left of this frame and came to this frame because you need additional help. O.K. See if this hint will give you enough information: this program is not designed simply to teach you to state some rules, it has other objectives also. If that hint tells you what the answer is, go back and answer frame 26. If you need more help. go on to frame 28.

28.
Here's a stronger hint: we want you to learn to apply the rule when you write frames, not just learn to say the rule. Did those three questions test your ability to use the rule? No. So how do we have to add to the criterion test? The answer to this question is the answer to frame 26; go back and answer that frame.

29.
The correct answer to frame 26 includes a statement to the effect that in our criterion test we need a question that asks you to apply the rule; that is, asks you to write frames in which you use the rule. Which would you expect to see in a test of ability to ski?

a. written questions about skiing.
b. performance test on skis.

a.____, b.____, Neither____, Both ____.

29)
See frame 30.

30.
That was an intentionally difficult question. The answer is BOTH. You might have said b, which at least indicates that you got the main point, that the test must include performance. You may not have known that there are many verbal rules we'd want to test also. For example; how do you signal a skier ahead of you that you are approaching from his rear and intend to pass? A written test could evaluate that objective. See, we need both in this case.

31.
There are two ways we might test your ability to apply the rule about unfamiliar new words. One we might call a discrimination test item, and the other we can call a performance test item. If we show you an example of a two-frame sequence and ask you if it follows the rule, this would be an example of a *________________________
______________________________________.

31) discrimination test item. The student must discriminate, or decide whether the characteristics of the rule are present or absent.	32. "Discriminate" means "tell the difference", or, "respond to the difference between a correct and an incorrect answer". Go back for a minute and take a look at frame 23. It is an example of a ________________ frame because you must select the one *________________ ________________ and must reject all of the *________________________.
32) discrimination; correct answer; incorrect answers.	33. A discrimination question might involve a written test, but it could also involve a real situation. For example, a question might ask, "Which of these circuit boards is correctly wired?" This question involves discrimination because the student must *____________ ________________________________.
33) select or identify the correct example (discriminate between the correct and incorrect examples, or any similar answer).	34. In a discrimination item and this includes discrimination questions in frames as well as in the criterion test, there is a limited number of choices or possibilities available to the student. Even if we point to an automobile and ask, "What make of car is that?", this would be a discrimination question because *________________________________ ________________________________.
34) there is a limited number of possible answers. NOTE: there is another reason, see frame 35.	35. The automobile example is a discrimination question for two reasons. One you just gave, and it refers to the response. The other part, or other reason is that you must discriminate something unique or specific about the stimulus. Let's clarify this: Discrimination involves a limited number of ____________ from which to choose, and also involves something identifiable or discriminable about the ______________.
35) limited responses from which to choose; some specific characteristic of the stimulus which tells you which response to choose.	36. If we say, "What make of car is that?" you are not likely to say "Washington", or "gazornenplatt", or "vestibule", or "programmed instruction". The limited possible answers would include names such as ______________, ______________ and ____________________________.

36) Plymouth, Ford, Chevrolet, or any other names of automobiles will do.	37. We might make the possible choices even more limited by asking a multiple-choice question. "Is that a Lincoln, a Cadillac, or an Imperial?" In either case, the number of possible answers is very ____________________in number.
37) limited (small).	38. One characteristic of a discrimination question is that the number of possible responses, from which the student is to select one is *________________________.
38) limited in number (not very large).	39. The other characteristic has to do with the stimulus. There must be at least one component or set of components of the stimulus that calls for one response rather than any other. If you are asked to identify a car, you cannot do so unless you can identify at least one ___________ that tells you what _________to say.
39) component; response (name, make, etc.)	40. Many people could not identify a given car because they cannot identify and respond to some unique ______________ of the car. They probably could identify a Volkswagon, or a two-passenger Thunderbird because each of these has several *____________________________________ ____________________________________.
40) component (characteristic); unique (or different) components or characteristics that are very visible and easily identified.	41. It is also probable that each person could correctly discriminate and identify cars of the same make as the one he owns. In your own words, what is the obvious reasons why this would be so? *____________________________________ ____________________________________ ____________________________________.
41) Because he has learned what it looks like and can respond to those components of its appearance by giving its name!	42. Consider the example of the student who is shown a number of wired circuit boards and is asked to identify the one that is wired correctly. In this case the student has learned how the board looks when correctly wired, he can compare all boards and find the one that has something about it that he can respond to by saying, "This one is correctly wired, all the others are incorrect." What were the limited possible responses here?*______________________ ____________________________________.

42) Each sample board is a possible selection. He can choose just one as the correct answer.	43. If we say to you, "Read a given two-frame sequence and tell whether or not they follow our "unfamiliar new word rule", what is the unique stimulus component you must look for? *____ ____. And what are the possible answers? *____.
43) Application of the rule (word is copied in the first frame; practiced but not copied in the second). Answers are: yes (they do) and no (they do not).	44. What are the two characteristics of a discrimination question?*________________ ____ ____ ____ ____ ____.
44) Limited number of possible answers to choose from; the stimulus must have one or more components that call for one response rather than any other (or some equivalent meaning).	45. Was frame 44 a criterion frame?____________. Would it make a good criterion question on a criterion test for this program?_________. Was the question in frame 44 a discrimination question?______________.
45) Yes; Yes; No (because there was no limited number of answers for you to choose from; you had to produce or construct the answer).	46. Frame 44 called for a constructed verbal response (written or spoken). Which of these is an example of a constructed verbal response? a. Correctly identifying a car. b. Defining "adaptive sequencing". a. ____, b. ____, Neither ____, Both ____.
46) b.	47. Which of these is an example of a constructed verbal response? a. A practice frame is *_____________. b. A review frame is basically another kind of blank frame. a. ____, b. ____, Neither ____, Both ____.
47) a. (the b. example is a discrimination question or example: the only possible choices are cue, copy, practice, criterion, information.)	48. Try these. Identify the constructed verbal response example(s). a. What is a program? b. Who was President during the U.S. Civil War? a. ____, b. ____, Neither ____, Both ____.

48)
a.

49.
If you answered frame 48 incorrectly, go on to frame 50. If you answered frame 48 correctly, skip to frame 52.

50.
You probably were wrong because you stumbled on example b.,thinking that it, like a., was an example. If so, you chose wrong because it was a discrimination question. You had to select the name from those names of Presidents that you know; the number of possibilities was limited. Names like Einstein and Mozart weren't even on the list of possibilities.

51.
O.K., now try this one. Which of these is an example of a constructed verbal response?

a. Writing the names of the 11 Confederate States.
b. Evaluating a student's answer to a question and deciding if it is correct or incorrect.

a. ______,b._____,Neither_____,Both_______.

51)
Neither. In the first example, the choices from which you select 11, is limited. In the second example the possible choices are limited to "correct", or "incorrect").

52.
Define "constructed verbal response".
*____
____
____.

52)
See frame 53.

53.
A constructed verbal response is a written or spoken response in which the student must produce or construct his answer in the form of a sentence or short essay defining terms or status relationships. (Your answer can be very general in frame 52, as long as it is roughly like this statement.) Open the APPENDIX to page 7 and write this definition in your own words. Use the space beside number 1.

54.
In the space beside number 2 on page 7 of the APPENDIX, write a definition of a discrimination question. You may refer to your answer to frame 44 if necessary.

55.
Another type of criterion question calls for performance of some sort, but we'll limit the classification to exclude verbal performance in a learning situation. Which of these is an example of a performance question?

a. Define "mediator".
b. Solder component "A" into the circuit board.

a. ___, b. ___, Neither ___, Both ___.

55)
b. (because definitions and statements of relationships are usually confined to classroom-type situations, we consider them constructed verbal responses.)

56.
Which of these is an example of a performance situation?

a. Writing a program.
b. Writing a sequence of frames as a response within this program.

a. ___, b. ____, Neither ____, Both _____.

56)
a. Here we seem to be splitting hairs, and we are! See frame 57.

57.
In the area of verbal behavior, there is no clear cut line between constructed verbal responses and performance. Here we called writing a program a performance task because it is a complex "real-life" situation, and the responder receives little or no guidance. Usually performance questions ask for non-verbal manipulative responses, but an unguided ,"real-life", verbal task is called performance also.

58.
In frame 57 we said that a performance question usually calls for *___________
______________________________,
but verbal tasks are called performance when they are *____________________
__________________________________.

58)
non-verbal manipulative skills (etc.); unguided "real-life" situations.

59.
Take out the APPENDIX again. In the space beside number 3, define a performance response. Then keep the APPENDIX handy.

60.
Now you have learned three types of responses. They are *________________,
*_________________________________, and
*_________________________________.

60)
discrimination, performance and constructed verbal response.

61.
The three types of responses are also three types of objectives and criterion questions. Suppose your objective is: "Student will be able to adjust the three screws on the gizmo so that it rests at a 15° angle to the gizatche." You would call this a
________________objective, call for
__________________responses in your sequence,
and use a _________________criterion test item.

61)
performance;
performance;
performance.

62.
By the same token, if your objective were: "Student will be able to name the three parts of the whatsis as the gizmo, gizatche and dorhinkle.", you would consider this a
*______________________________objective,
call for *___________________responses in
your sequence, and ask for a *___________
_____________________in your criterion
test.

62)
constructed verbal response; constructed verbal; constructed verbal response.

63.
The important thing is not that you are able to label your objectives, responses and criterion test items, but that you require the student to make the same type of responses in your sequence that he will need in the "real world". For example, if he needs to be able to write objectives, just be sure he practices *______________
_____________________________________.

63)
what he must be able to do in the "real world" (writing objectives).

64.
Take out your APPENDIX again. In the space reserved for "Note concerning the classification of objectives" make a comment to the effect that correctly catagorizing your objectives and responses is not nearly as important as making sure the student practices the response the way he'll need to know it outside of the program. Refer to this frame and frame 63, but state the idea in your own words.

65.
Now suppose you want to teach a performance response, consisting of pulling and pushing three different levers that operate a toy crane by remote control. Do you think your sequence would contain any frames that required other than performance responses?

No - go to frame 66.
Yes - go to frame 67.

66.
You say your sequence would only have performance response frames! How are you going to teach which lever is which? That is a discrimination response. Do you think you might teach them to name or describe the action of the levers? Your sequence might contain several frames that asked for responses other than performance. Go on to frame 67.

67.
Your sequence would probably contain some discrimination frames and perhaps some constructed verbal responses, to help you teach the performance responses that are your major objectives.

68.
In a fairly longsequence teaching a performance objective, you might have many frames that call for ________________ responses or ________________ ________________ responses. Because they support your main objective, we call them ________________ responses.

68)
discrimination;
constructed verbal;
supporting.

69.
In the sequence designed to teach the student to push and pull different levers, a frame teaching him to discriminate between the levers would be called a ________________ discrimination frame.

69)
supporting.

70.
Take out your sequence on the MD pyramid for a minute. In frames 14-17 you teach that one letter over another means divide, while side by side they mean multiply. Are these responses required in the criterion question? ____________.

70)
No.

71.
The responses in frames 14-17 are not required in the criterion question, and they are not among the original objectives of the sequence. One of the objectives is that the student be able to pull multiplication and division examples out of the MD pyramid. To do so correctly he must learn that relationship of the letters. Because these "non-objective" responses are used to help teach the objective, we call them *____________________
______________________________.

71)
supporting responses.

72.
To review, you may label three types of objectives according to the kind of response they require. They are *__________
____,
*____
and *______________________________________.

72)
discrimination,
constructed verbal
response, and
performance.

73.
Label these responses according to the three types you just listed.
  a. focusing a camera
  b. taking an essay test
  c. writing a letter
  d. labeling types of responses.

73)
a) performance
b) constructed
   verbal response
c) performance
d) discrimination.

74.
We said, more important than being able to label the objectives, you should teach them *____________________________
______________________________(how?).

Go on to the discussion.

DISCUSSION: FOLLOWING CHAPTER NINE.

We've come a long way since you read the first frame of the introduction. As we went along we have tried to foresee your questions about this program and the way it was written. Since we are now approaching the topic of objectives, let's look for a minute at two questions that might have occurred to you. The first topic is that of the techniques and procedures in this program that actually seem to violate the very rules the program is teaching you. The second topic is the nature and purpose of these discussion sections.

Not often, but every now and then, this program will violate, or appear to violate one of its own rules completely. In some cases, for example, a copy frame will not be followed immediately by a practice frame, but by another copy frame for a different response, and then both responses will be practiced together in the next frame. There is no "law" against this, of course, nor against violating any of our frame writing or sequence writing techniques or procedures. We've called them "rules", but actually they should be referred to as "guides". We do feel very strongly, a view produced by experience rather than intuition, that the rules that you are learning in this program are valuable guides, and that you will become a better programmer faster by learning first to follow the rules in a very exact fashion. Later, after you have had considerable experience, and have "developed a feeling" for programming, you will probably begin to modify certain rules to fit various types and kinds of objectives. It is a novel procedure to think first - always before writing a frame - of the response that you are aiming for, rather than simply starting in to lecture about the objective. Every frame in this program was written by following that one basic rule - decide first exactly what response you want the student to make, and then write a frame that will produce that response. When you have developed this programming "habit", you will find that most of the other rules will fall into place. At that point in your development as a programmer you will be able to start modifying rules appropriately when necessary, but you will also find that it is generally easier to follow the rules than violate them!

You have noticed that this program contains some "lecture frames" that do not call for any responses, and you may have wondered how we justify their presence in a program that supposedly specifies a response in every frame. Well, lecture frames are written in this program for one of two purposes: (1) As general illustrative or lecture material, not designed to teach any specific objective, put there as enrichment or orientation content to which you may respond as you choose. We are not concerned with controlled practice, and offer the content of a lecture frame as a sort of sign post or display that does not contain critical stimulus material. (2) The second purpose is a simple modification of our usual procedure of putting the correct answer to a frame in the left hand side of the next frame. We want the "feedback" (confirmation, reinforcement, whatever name we want to give it) to be as clear and unambiguous as possible, and often we will use the space of the next frame to provide a lecture explanation of the reason for the previous response. We can only do this when you have already learned enough about the answer to allow us to present stimuli that allow you to respond appropriately to our explanation (in other words, to "understand" the explanation).

Question 1: We say that rules are made to be broken, and in this program you will find examples where we have broken, or slightly modified, our own rules. Why then do we want you to learn and to follow each rule so very precisely?

Question 2: What one basic rule is never violated?

Question 3: What are the two functions of a "no response", lecture frame?

Another question that might have occurred to you is this: "What about these discussion sections? What kind of programming is this - or is it programming? Why mix this kind of presentation in with the small step approach?" Well, although there is, as yet, no great uniformity in the programming field concerning a label for this kind of presentation, many programmers refer to this type of format as an "adjunct", or "adjunctive" program. The dictionary defines the word "adjunct" as "something added to something else, but not essentially a part of it". In other words, we have added active responding in the form of questions and answers at the end of the textual material without building it into the text sentences as we do when we write a regular program. We could do the same thing, using a textbook or manual as the text and just write questions to follow fairly a small amount of text material - a paragraph or two, or a page or two. In an adjunctive program the student does not receive as much systematic support, guidance, and help as he does when he uses a small step, controlled practice type of program. In an adjunctive program we are concerned primarily with requiring that the student read the material attentively. We do this by asking questions that make him respond at least actively enough to find the appropriate response material in the text and use it overtly at least once in answering the questions. There is no attempt to connect specific responses to specific stimuli, break the material into small steps, build behavior toward criterion performance, provide extensive, controlled practice, or produce any predictable retention. In other words, there is almost none of the systematic instruction that a controlled practice, small step sequence provides. Some of the content of the discussion sections serves the same purpose as a lecture frame; presenting information, or providing a statement of an attitude or orientation. Another use for these discussion sections is to have you put rules, definitions and procedures you have learned into the APPENDIX for future reference. Basically, however, these discussion sections are used to present information, and require you to read and use the information so we can have some assurance that you will not simply ignore the material. By asking a question, we offer you a method of checking to see that you did come into contact with the relevant information.

An objective must be learned and remembered by the student, so we must teach it. Enrichment, on the other hand, can simply be presented along with some requirement that the student "pay attention" to it. Remember, however, that material presented in a narrative discussion section is never counted on to be learned. (To be sure that you do remember this, we will program it in a later unit.) If a principle, concept, or procedure is an objective, which means that it is to become a lasting part of the student's behavioral repertoire, we teach it in the small step, controlled practice portion of the program rather than in the discussion sections. Enrichment can be presented in almost any form; lecture, text, film, picture, etc., but we cannot count on enrichment being retained. An objective, however, must be learned and retained, and the program shares this responsibility with the student, while in the case of unprogrammed material the responsibility is left almost entirely up to the student. We might call a student a failure if he flunks a test, but we wouldn't call his teacher or textbook a failure. In the case of a program, however, if the student fails after cooperating with the program, then we must place the responsibility, or at least the main portion of the responsibility for failure, upon the program!

Now answer these questions:

1. We call these discussion sections examples of "adjunctive programming". Exactly what is meant by "adjunctive programming"? What is the main purpose of an "adjunctive program"?

2. What is the difference between an objective, and enrichment?

3. What are the main features of the programmed units that are not characteristic features of these discussion sections? That is, what characteristics are not present in an adjunctive program?

CHAPTER NINE POST-TEST.

1. What kind of test measures every objective of the lesson?

2. What kind of test samples the lesson's objectives?

3. All of these pre-test and post-test questions are criterion test items. State the objective of this program for which question 2 above is a test item.

4. What are the two characteristics of a discrimination question?

5. Define "constructed verbal response".

6. Which of these are performance criterion test items:
   (more than one may be correct)
   a. building a dog house
   b. writing lecture notes
   c. demonstrating proper diving form
   d. taking a test of driving rules
   e. defining an information frame
   f. writing a program

7. How should you teach an objective, regardless of the response-type label you put on it?

ANSWERS TO CHAPTER NINE POST-TEST.

Question	Answer
1.	Frames 3 - 7.
2.	Frame 7 (7-9).
3.	Student will be able to label the kind of test that samples the lesson's objectives as an achievement test.
4.	Frames 32 - 44.
5.	Frames 46 - 52.
6.	Frames 55 - 59.
7.	Frames 63 - 64.

CHAPTER TEN PRE-TEST.

1. List the three types of objectives, in the order of teaching complexity, from least to most complex.

2. How do you classify objectives that fall on the borderline between two of our three types of objectives?

3. Describe each of the following sequences in terms of the relative number of each type of response it would probably contain: Verbal performance, constructed verbal response and discrimination sequences.

4. Name and describe fully the type of information frame that usually begins a DISC sequence.

5. Here is a discrimination objective. Write the first two frames of the teaching sequence.

> Defensive football formations are named for the number of players in each basic position (line, linebacker, back and safety). . The student will be able to discriminate names of defensive football formations, such as "6-2-2-1", "7-1-2-1" and "5-3-2-1", from other formations, such as the offensive formations "split T", "T", "I", "short punt" and "flip-flop".

6. You are writing a discrimination frame that requires the student to "fill the blank". What do you do if the relevant set of choices is not obvious to the student?

After a little practice discriminating types of objectives, and learning something about the sequences designed to teach different objectives, you will see a couple of discrimination sequences. In learning to write DISC sequences in this chapter, you'll also add a new information frame to your collection.

1.
Review: name and describe each of the three types of objectives.*____________
____
____
____
____
____.

1)
See frame 2.

2.
Discrimination; limited choices, identifiable stimulus component. Constructed verbal response; written or spoken, produce or complete a statement or answer. Performance; carrying out a task, manipulating, doing some motor act (etc.), in a fairly real-life situation.

3.
Use the abbreviations DISC (for discrimination), PERF (for performance), and CVR (for constructed verbal response), and indicate which type of objective is represented by each of these sentences:
1. Draw an M-D triangle. ___________.
2. What kind of example is: G = RX? _________.
3. What is a Neon Tetra? ______________.

3)
1. PERF (process of elimination; it is neither DISC or CVR and it is a task.
2. DISC (student has learned only two possibilites).
3. CVR.

4.
Use the same abbreviations and label each of these sentences:
1. What type of frame is frame 1 above?________.
2. Take driver's test. ______________.
3. Write a program. ________________.
4. What kind of objectives are involved in each of the four questions in this frame?_________.

4)
1. CVR.
2. PERF (and usually DISC since most States also give multiple-choice written tests).
3. PERF (complex, real-life task).
4. DISC (there are only three choices).

5.
Try it again.
1. Define "voltage". ________________.
2. Repair a radio. _______________.
3. Write objectives. _______________.
4. Select the correct definition of "capacitance". ________________.
5. Repair a watch. _______________.
6. Draw an electric circuit. __________.

5)
1. CVR.
2. PERF (and DISC, since problem must be discriminated before it can be corrected).
3. PERF (and DISC, since nature of objectives must first be discriminated).
4. DISC.
5. PERF (see #2).
6. PERF.

6.
You'll notice from the answers shown on the left that more than one kind of objective can be involved. Writing objectives is a complex performance, and it also involves and requires correct ____________________ of the type of objective represented.

6)
discrimination.

7.
Frames 3, 4, and 5 all required responses based on _______________________; you had to be able to ___________________the kind of objective represented.

7)
discrimination; discriminate (identify; label, etc.).

8.
Practice the discriminations again:

1. Demonstrate how to drive a nail.__________.
2. Drive a nail. ________________.
3. Define "hailstone". _______________.
4. What is a "criterion test"? ____________.
5. Which of these names is the name of the person who discovered radium? ___________.
6. Take a short-answer essay test. _________.

8)
1. PERF.
2. PERF.
3. CVR.
4. CVR.
5. DISC.
6. CVR (or PERF, depending on how complex you consider the activity to be).

9.
Notice that number 6 is one of those borderline cases between a complex CVR and performance. But this is no problem. It really doesn't matter what you call it as long as your frames require the student to practice.
*____
____.

9)
the response as he will need to know it (what he will need to use outside the program, etc.).

10.
Because it involves a limited number of choices, the easiest type of objective to teach is the ______________response.

10)
discrimination.
(DISC)

11.
Of the behavior we identify as an objective, the least difficult to teach is the ______________type of response. Next in teaching complexity is the response of one word to a short essay, the *______________________________.

11)
DISC;
CVR (Constructed verbal response).

12.
The most difficult type of response to teach, because it usually involves a series of manipulations or a very complex, unguided verbal skill, is the *______________________________. Next in order of teaching difficulty is the *______________________________, while the least difficult to teach is *______________________________.

12)
PERF response;
CVR;
DISC response.

13.
Our classification of objectives has value and can be useful. In borderline cases, however, don't fight the problem, just play it safe. Can you guess what this means when you're trying to decide whether an objective is CVR or PERF?

Consider it a CVR - go to frame 14.
Consider it a PERF - go to frame 15.
Consider it a DISC - go to frame 16.
I have no idea - go to frame 17.

14.
You'd consider it a constructed verbal response rather than performance or discrimination! That isn't playing it safe. Remember what we did in the case of "general" and "specific" terms? We played it safe there by taking a chance on "overprogramming" rather than "underprogramming". That hint help? Go back to frame 13 and try again.

15.
You would decide to consider it a performance objective, would you? Well that is exactly what we want you to do. Since we consider performance more complex than a constructed verbal response, we'd play it safe, taking a chance on "overprogramming" rather than "underprogramming". We decided to do the same kind of thing earlier in regard to "general" and "specific" terms in frames. Go on to frame 18.

16.
You'd consider it a discrimination type of objective! Why? The problem was between two more complex classifications, so this choice is not really even a possibility in this case. Return to frame 10 and try again. If you are sure that you can't figure out the correct answer, admit it and go on to frame 14.

17.
You don't know! The key hint was the part of frame 10 that said "play it safe". We did that before when we considered "general" and "specific" frame content. Remember? We played it safe by being sure that we didn't leave out anything essential. Now that hint should aim you in the right direction. Return to frame 10 and choose the correct answer.

18.
When in doubt concerning a borderline case, assign the objective to the more complex of the two classifications involved. If the two classifications are CVR and PERF, consider the objective to be a ________.
If between DISC and CVR, consider it to be a ____________ objective.

18)
PERF;
CVR.

19.
Suppose you are writing a program on economics. You are trying to decide if it's necessary that the student be able to define "laissez faire" economic policies, or merely be able to recognize whether a certain policy is or is not "laissez faire". What do you decide?*________________.
With what type of sequence do you teach it?
*____________________________________.

19)
He must be able to define it.;
Probably use a CVR sequence. (call for CVR responses.)

20.
On the other hand, suppose you had decided that the student must be able to write a lengthy essay on the subject. Although this task is complex enough to be considered verbal performance, you would probably use many __________and *__________________besides performance response frames.

20)
CVR;
DISC.

21.
In fact, when programming verbal performance, you will probably use more CVR frames than PERF's and DISC's together. You may have noticed that in this program you are learning a verbal performance skill, but responding to a large number of *_____________________________frames, and fewer *____________________and *_______________.

21)
CVR;
PERF frames;
Disc frames.

22.
A verbal performance objective is one of the __________(most, least)complex to teach. In a typical verbal performance sequence you would find about 75% _______ frames and 25% ____________and _________ frames.

22)
most complex;
CVR;
DISC and PERF.

23.
In a sequence designed to teach a constructed verbal response, such as a definition, you would not see performance frames. A CVR sequence consists, of course, of many __________frames, and perhaps also some ____________frames.

23)
CVR;
DISC.

24.
While a verbal performance sequence consists mainly of ________frames, with fewer ________and __________frames, and a constructed verbal response sequence will have many _________frames but maybe a few ________frames, a discrimination sequence will probably have only _______ frames.

24)
(PERF) CVR;
DISC and PERF;
(CVR) CVR; DISC
(DISC) DISC.

25.
The more complex objectives, then, may requires a greater variety of frames in the sequence. A verbal performance sequence would probably consist of
*_______________________________,
a CVR sequence would contain *________
_________________________, and a
DISC sequence would probably have
*_______________________________.

25)
many CVR frames,
fewer PERF and
DISC; many CVR's,
a few DISC's;
only DISC's.

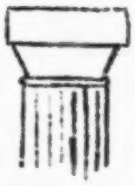
26.
We've hinted before that there were more than the two types of information frames we have mentioned so far. To accomplish discrimination objectives, the programmer often uses an "immediate application" frame. Now the three types of information frames you have heard of are _______,
__________, and _______________
________________frames.

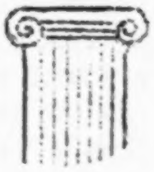
26)
cue, copy,
immediate appli-
cation.

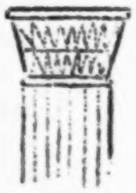
27.
For lack of a better name, we call the third type of information frame we are about to study an __________
_______________ frame.

27)
immediate appli-
cation.

28.
Here is an example of an immediate application information frame:
An ionic column has a small roll or scroll at the top. Which of these is the top of an ionic column?

(a)

___

(b)

___

(c)

___

28)
b.

29.
In the frame above you didn't copy, nor was an existing association used. You were given a small bit of information and applied it immediately. This is, of course, why we call the frame an
*_______________________________.

29)
immediate application frame.

30.
Here is another example of an immediate application frame:
A verb denotes action. Which of these words is most likely to be a verb?

(a)____wall, (b) ____throw, (c)_____cigarette.

30)
b. (throw)

31.
And here is another example:
This is a quadrangle.

How many sides does it have? ___________

31)
four sides.

32.
In the quadrangle frame you were not given the number of sides but were shown a quadrangle and could count them. We call it an immediate application frame because the information provided by the illustration was ____________ ______________ by the student to answer the question.

32)
applied (used) immediately.

33.
An immediate application frame is an information frame in which the student reads a small bit of information, then *________
____________________________________.

33)
he applies the information immediately.(etc.).

34.
In the quadrangle example you had to count the number of sides. In the other two examples you were given a multiple choice question, and had to judge whether each choice was correct or incorrect. The only two types of responses to an immediate application frame are: a mathematical operation or a _____________ _____________ question.

34)
multiple choice.

35.
The quadrangle frame required a mathematical operation, though a very simple one (counting sides). An immediate application frame uses either a _____________
______________ question or a
______________ __________________.

35) multiple choice; mathematical operation.	36. To square a number, you multiply it by itself. To square 7, you multiply ______ times _______. When you square 7 you get _______. This is an immediate application frame that requires the student to perform a *_________________________. The responses are not words, they are _______________________.
36) 7 X 7 = 49; mathematical operation; numbers.	37. An immediate application frame either requires a *_________________________, and response that consists of __________, or asks a *_________________________.
37) mathematical operation; numbers; multiple choice question.	38. Every frame that contains a multiple choice question is not an immediate application frame. An immediate application frame must contain some new information that the student must *______________________. Could a practice frame that contains a multiple choice question be considered an immediate application frame? _________. Why, or why not?*______________________ _____________________________________.
38) apply immediately; no; it does not contain new information (is not an information frame.).	39. In summary then, an immediate application frame has certain characteristics. It must present *__________________ which the student *_________________________, and it must ask either a *______________ ______________________ or*___________ __________________________.
39) new information; uses immediately; multiple choice question or mathematical operation.	40. In a multiple choice question, the student must discriminate between correct and incorrect answers. As you might expect, a discrimination sequence uses many ___________ _______________ questions, and frequently uses the kind of information frames we call *_________________________________.
40) multiple choice; immediate application frames.	41. Let's examine a discrimination sequence, in which the student is taught the characteristics of something by learning to discriminate or distinguish it from other things. The student will be able to discriminate similes from non-similes, then discriminate metaphors from similes and label each. This is a statement of our ____________________.

41)
objectives.

42.
A simile is a sentence that uses "like" or "as" to describe one thing by comparing it with another. Which of these is a simile?

a. _______The car is blue.
b. _______They like the car.
c. _______He drives like a demon.

42)
c. He drives like a demon.

43.
Which of these is a simile?

a. ______A program is like a tutor.
b. ______A program is a tutor.
c. ______Both.
d. ______Neither.

43)
a. A program is like a tutor.

44.
A metaphor doesn't use "like" or "as" but usually describes something by saying it "is" something else. For example: "His mind was a steel trap", "His tie is a rainbow", "A program is a personal tutor". Change this simile to a metaphor:
"Their garden is like a jungle."

44)
see frame 45.

45.
"Their garden is like a jungle." To change this simile to a metaphor, simply cross out the word "like". "Their garden is a jungle."
Which of these are metaphors?

a. ______His smile was frozen.
b. ______His eyes were like small beads.
c. ______The office was a beehive.

45)
a. and c. are metaphors.

46.
Notice that metaphors are exaggerations, saying something is or does something impossible ("frozen" smile, "beehive" office). Here are some more examples of metaphors: "She flew across the room.", "Her remarks burned him up.", "He threw himself into the project."
Which of these are metaphors?

a. _____The necklace weighed a ton.
b. _____The necklace was a wall between them.
c. _____The firey necklace was a magnet for all eyes.

46)
All three are metaphors. Notice that the last sentence had two metaphors, the "firey necklace" and the reference to it as a magnet.

47.
Change these metaphors to similes:
The giant plane was a hulking beast.
* ______________________________.
Her handwriting was a spidery pattern of lace.
* ______________________________.

47)
simply insert the word "like".

48.
In this sequence so far the student has never written the words "simile" or "metaphor", nor has he written a description of either one. He has learned to identify examples of each by using information given him. But since he has responded to those labels in every frame, he will be able to produce them himself in the next frame, right?__________.

48)
WRONG! If you missed this, work the sequence in chapter 5 again, beginning with frame 6.

49.
So we can't be sure he can produce the labels. If we want him to do so, we must add frames to teach him:
Identify each of these statements by labeling each a simile, metaphor, or neither:

________The road was a ribbon of concrete.
________He showered them with his anger.
________His anger was like a storm.
________He was angry.

49)
metaphor.
metaphor.
simile.
neither.

50.
A figure of speech that uses the words "like" or "as" is called a __________.

50)
simile.

51.
"The bird's song was a vibrant whistle of joy." That sentence is a __________.
By adding the word "like" or "as", you can change it to a __________ and it would look like this:
* ______________________________.

51)
metaphor;
simile;
The bird's song was like a vibrant whistle of joy.

52.
A discrimination sequence generally begins with an explanation of the general concept. Then one example is shown and the student is asked to say "yes" if the example is correct or "no" if it isn't. Another possibility is to show several examples, only one of which is correct. Frames*__________ are examples of this.

52)
Frame 28,30,42.

53.
The first frame is an information frame of the sort we call an "immediate application" frame. Remember that there are three kinds of information frames:
(1)____________,(2)____________, and
(3)*________________________________.

53)
cue; copy;
immediate application.

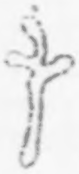
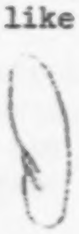
54.
After the immediate application frame, we write a DISC practice frame, in which the same discrimination is to be practiced without the information available in the frame. In this frame we can add more examples, some relevant and some irrelevant. Frames*________are examples of DISC practice frames. (Which 2 in the sequence from 42-46?)

54)
Frame 43, 45.

55.
Let's see how this works. The next four frames illustrate a DISC sequence. Work through them and then we'll ask some questions about them.

56.
A paramecium is shaped somewhat like the sole of a slipper. Which of these do you think is meant to look like a paramecium?

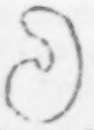
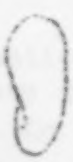
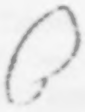
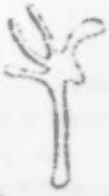
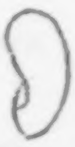
(a)

(b)

(c)

(d)

_____ _____ _____ _____

56)
c.

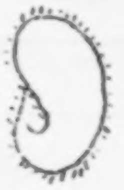
57.
Which of these are paramecia?

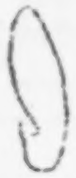






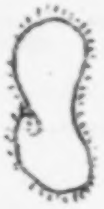
(a)____(b)____(c)____(d)____(e)____(f)____

57)
c, d and f.

58.
A paramecium is covered with tiny hair-like projections called cilia. Which of these represents a paramecium covered with cilia?



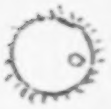


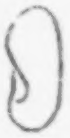


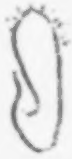
(a)________(b)________(c)__________

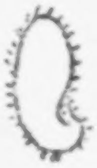
58)
a and c.

59.
Considering what you know about paramecia so far, which of these most accurately represent paramecia?









(a)________(b)_______(c)_______(d)_______

59)
d.

60.
Frame 42 is an information frame of the type that we call an *_______________ _________________frame. Frame 43 is a *__________________________frame.

60)
immediate application;
DISC practice.

61.
Describe an immediate application frame:
*______________________________________
____
____
____.

61)
An immediate application frame presents new information to the student, which he must apply immediately to answer a multiple choice question or perform a mathematical operation.

62.
To be correct, your description must include the four ideas underlined on the left of this frame. Now put your definition in the APPENDIX on page 12.

63.
Like any information frame, an immediate application frame must be followed by a practice frame, in this case, a ______________________practice frame.

63)
discrimination.

64.
So far you know that a DISC sequence usually begins with *____________ ____________information frame followed by a *__________________ ______________________________.

64)
immediate application;
DISC practice frame.

65.
Suppose you are writing a DISC sequence to teach this objective: Student will be able to discriminate nouns from other words listed. What kind of question would you ask in your first frame?*_____________________________.

65)
a multiple choice question (the only other possibility in an immediate application frame is a math operation __ hardly appropriate!)

66.
Here are examples of two kinds of multiple choice questions:

1) Is an immediate application frame an information frame?__________
2) Which of the following is a (are) information frame (s)?
a)__copy b)__criterion c)__cue

66)
1) yes.
2) a and c.

67.
In the first example, the student merely had to answer ________or___________. In the second he had a similar decision to make three times. He had to say ________or_________to each of the possible answers listed. He made more discrimination responses in the ________ (first, second) example.

67)
yes or no;
yes or no;
second.

68.
So of the two kinds of multiple choice questions shown ("yes or no" type and "abc" type) the easier is the *______ type of question, and the more difficult is the *__________type.

68)
yes or no;
abc.

69.
O.K., let's write that discrimination sequence for the objective in frame 65, discriminating nouns from other words. Your immediate application frame will probably begin with a general statement, such as, "A noun is a name word", or "A noun is the name of a person, place, or thing." Write the frame, then return to frame 70. (You may want to check the examples of multiple choice questions in frame 66.)

70.
Your frame must present the information, as in a general statement, then ask a multiple choice question which requires the student to use that information.
For example:
A noun is a name word, such as the name of a person, place or thing. Is the word "boat" a noun? ______(yes or no)
or
(general statement as above) Which of these words is a noun:
a.__think b.__on c. __boat

70)
(answers to examples)
yes; c (boat).

71.
Now go ahead and write the next frame to follow your information frame. The frame you are about to write is, of course, a *_________________frame. After writing the frame, go on to frame 72.

71)
DISC practice.

72.
Your DISC practice frame must require the student to identify nouns, without the information he had available in the previous frame. You may have used either of the types of multiple choice questions but probably preferred the more difficult type, which is the
*_______________________________.

72)
"abc" type (kind
that offers
several choices).

73.
So your practice frame would look something like this:
Which of these words is a noun?
a. __ because b.__ Boston c.____run.

73)
b. (Boston).

74.
You know there are other kinds of DISC frames than those which ask multiple choice question. For example:
The three kinds of information frames are ________, ______________and
*______________________________frames.

74)
cue, copy and
immediate application frames.

75.
What are the two characteristics of a discrimination frame?
*________________________________
____
_________________________________.

75) 1) limited number of choices for response 2) unique component(s) of stimulus that lead to one response rather than another. (If you missed this, rework frames 34-44 in Chapter nine.)	76. List the possible choices from which you selected the answers to frame 74. *______________________________ ______________________________ ______________________________ ______________________________ ______________________________ ______________________________.
76) cue, copy, criterion, practice, combination, review and immediate application frames.	77. If there is no doubt what the choices can be, as in the case of the student who has learned the names of the frames, we do not have to list the choices in the frame. Would we have to list the choices in this frame? A desk is blank than a table. Yes or no? ________Why?*__________ ______________________________.
77) Yes; can't tell what the choices are. (What are the choices? You might say, "stronger", "costlier", "heavier", "prettier", "handier", "smaller", "better", "neater", etc., etc.)	78. If there is any possibility that the student might consider the wrong set of choices while answering a discrimination frame, we solve the problem by __________the relevant set of __________in the frame.
78) listing (writing, presenting, etc.); choices.	79. If the relevant set of choices might not be obvious to the student, we will *______________________________, but if the choices are obvious to the student, then we *______________ ______________________________.

79) list the choices in the frame; don't need to list the choices in the frame.	80. Look at this frame: "He ripped through the house like a tornado." This sentence is a _________? Is this frame adequate to appear at the end of the metaphor-simile sequence (frame 51)? ___________. Is the frame adequate to appear without similar preparation? ________. If either answer is "no", tell why, and how you'd change the frame to fit that situation.*______ ________________________________ ________________________________ ________________________________.
80) yes; no; the choices are not obvious to the student. (he could say "statement", "simile", "figure of speech", etc.) list the choices in the frame.	81. In order of teaching complexity, least to most difficult, the three types of objectives are *____________________ ________________________________ ________________________________. Turn to page 7 of the APPENDIX and put this information by number 4.
81) discrimination (DISC), constructed verbal response (CVR) and performance (PERF).	82. A typical verbal performance sequence would consist mostly of ______________ frames plus *________________________. A CVR sequence would probably contain *______________________________. A DISC sequence would likely consist of *______________________________. This information goes by number 5 on page 7 of the APPENDIX.
82) CVR; some DISC and PERF frames; almost all CVR frames, some DISC; all DISC frames.	83. On page 14 of the APPENDIX you will find the words "Discrimination Sequences". In the space provided write what you have learned about DISC sequences and frames, and copy your sequence on nouns into your notes. Then check back in Chapter 10 to frames 64, 66, and 79 to be sure you haven't forgotten anything.

DISCUSSION FOLLOWING CHAPTER TEN

The student must practice in the program the same behavior he will need to know in the "real world". This idea was not new to you in Chapter ten. In previous chapters you learned, for example, that if the student is to write frames, he must practice writing frames, and if he is to be able to apply a general concept, he must practice applying that concept to several different examples. It is the same as saying that the student must make relevant responses. This principle is basic to programming, and should be kept in mind as you continue this unit on objectives.

You will go on now to learn one method of preparing objectives. It is not the only way, but it is thorough and efficient.

When you state your objectives, first as a broad statement of the objectives of the whole program, think, "What must the student be able to do after he has completed the program?". This terminal behavior should resemble as closely as is practical the behavior required of the student in a real life situation. (It would not be practical, for example, to arrange an attack or even practice alert so that civil defense volunteers could complete the criterion test for a program on emergency procedures!)

Next you will make a list of the student's responses, in effect, a list of all the criterion frame responses, which will specify each minute objective of your program. It is at this point that you decide what form each response will take, whether a performance, discrimination or constructed verbal response. To make these decisions, you must keep our basic principle in mind.

What is the basic principle you must remember as you prepare your objectives?

CHAPTER TEN POST-TEST.

1. List the three types of objectives, in the order of teaching complexity, from least to most complex.

2. How do you classify objectives that fall on the borderline between two of our three types of objectives?

3. Describe each of the following sequence in terms of the relative number of each type of response it would probably contain: Verbal performance, Constructed verbal response, Discrimination sequence.

4. Name and fully describe the kind of information frame that usually begins a discrimination sequence.

5. Here is a discrimination objective. Write the first two frames of the teaching sequence.

   Defensive football formations are named for the number of players in each basic position (line, linebacker, back and safety). The student will be able to discriminate names of defensive football formations, such as "6-2-2-1", "7-1-2-1" and "5-3-2-1", from other formation names, such as the offensive formations, "split T", "T", "I", "short punt" and "flip-flop".

6. You are writing a discrimination frame that requires the student to "fill the blank". What do you do if the relevant set of choices is not obvious to the student?

7. What'is the basic principle you must remember as you prepare and classify your objectives?

ANSWERS TO CHAPTER TEN POST-TEST.

Question	Answer
1.	Frames 10 - 12.
2.	Frame 18.
3.	Frames 20 - 25.
4.	Frames 27 - 39.
5.	Your frame 1 is an immediate application frame, must contain a) general statement of information, for example: "Defensive football formations are named for the number of players in each basic position." b) multiple choice question, such as: "Could this be the name of a defensive football formation, 7-1-2-1 ________(Yes or no?)"or "Which of these could be the name of a defensive football formation? a)_______"T", b)_____7-1-2-1, c)_________short punt" Frame 2 is a discrimination practice frame, must contain a question that requires the same discrimination as frame 1, for example: "Which of these could be names of defensive football formations? a)________Split "T", b)_______6-2-2-1,c)______5-3-2-1"
6.	Frames 77 - 79.
7.	Discussion.

CHAPTER ELEVEN PRE-TEST

1. Describe two ways to provide confirmation in a performance sequence.

2. List and describe the first two steps of preparing objectives for programming.

3. Name and briefly describe the two S-R tables that number among the five steps of preparing objectives.

4. What part of writing a program generally takes the most time and effort, writing frames, preparing objectives or testing and revising the program until it works?

5. What becomes the stimulus for each succeeding response as a student practices a sequence of responses under the guidance of a program?

The brief demonstration of a performance sequence in Chapter eleven continues the unit on objectives.

1. So far you have had some practice writing DISC and CVR sequences. Let's see what a simple performance sequence looks like. Which of these is an example of a PERF response?

____a. Plug in a soldering iron.
____b. Turn on a radio.
____c. Both.
____d. Neither.

1)
c. Both.

2.
We've already discussed the more complex verbal performance sequences, which are composed mainly of ________(DISC, CVR, PERF) frames, and of which there are many examples in this program. Now we'll turn to the programming of a non-verbal skill. The following sequence will be about Japanese paper folding, and you'll learn how to make a paper helmet.

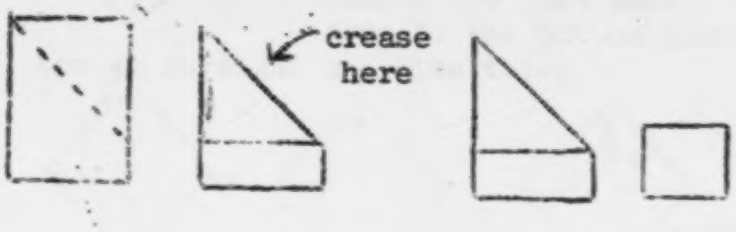
2)
CVR.

3.
Have you ever heard of Origami? (Pronounced Or-ij́-ah-me) It's the Japanese art of paper folding. Although some of the items that can be made this way are complex, we'll look at a simple example. First you need a couple of sheets of paper. Full sized typing or notebook paper will do. Get the paper, then put a check mark in this block. ☐

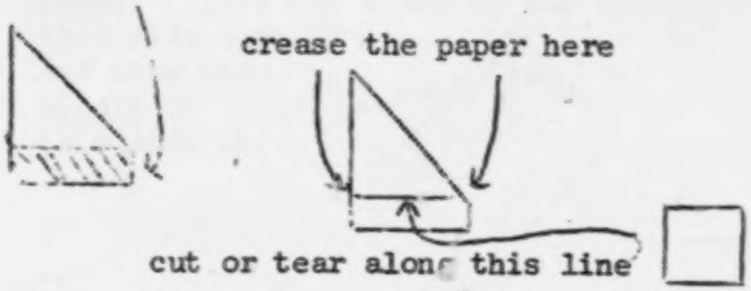
4.
As you complete each step, put a check in the block in the frame you just completed. O.K., lay a sheet of paper in front of you and put this program slightly to the side so you can read it while folding the paper.

☐

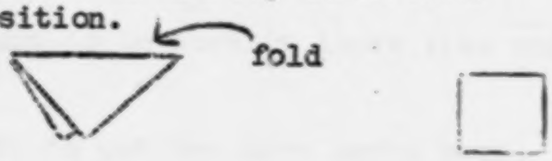
5.
The paper is probably rectangular and must be trimmed down to a square. The easiest way to get a perfect square is to fold over one corner like this.


crease
here

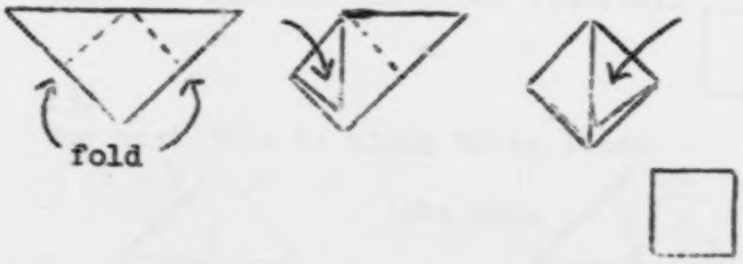
6.
Now this rectangular piece must be cut or torn off.


crease the paper here
cut or tear along this line

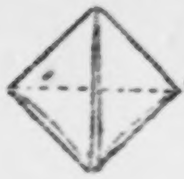
7.
Now open the first fold you made and you have a square piece of paper. Now fold it again as it was and lay it so it's in this position.



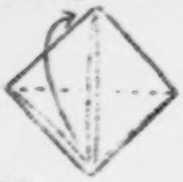
8.
Next you will fold the left and right corner toward you like this --

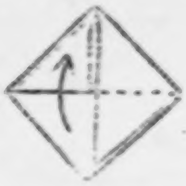


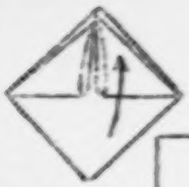
9.
The paper now looks like this:



The next fold is across here; each of those points you just bent down to the bottom must now go straight up, like this:







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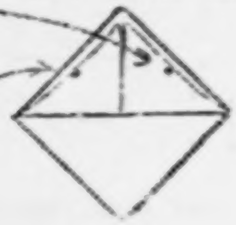
10.
The next step is easiest to do by using a pencil or pen to mark a point on the paper. First put a dot in the middle of this side, here, And then the middle of this side, here



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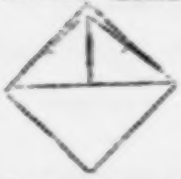
11.
The paper now looks like this:



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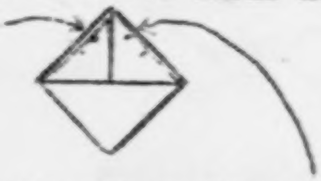
Check yours to be sure it looks like this.

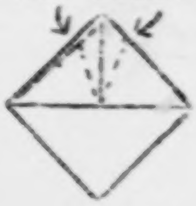
12.
Now you're to put two more marks here, half way between the first dot and the edge.



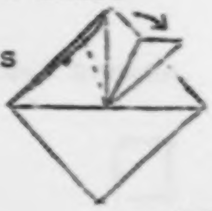
Then the same on the other side, here.

☐

13.
The next fold is along these lines



like this



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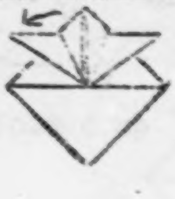
14.
Now fold the other side like this:



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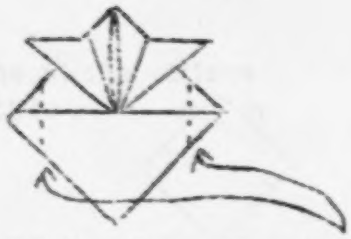
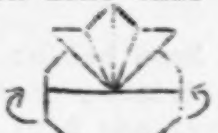
15.



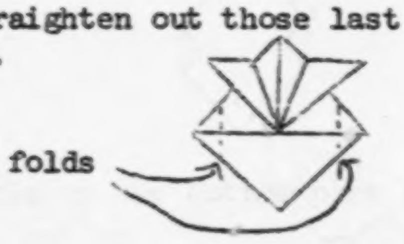
The next fold is along these lines
Fold each side back like this



Crease the folds.

☐

16.
Now straighten out those last two folds again.



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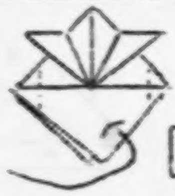
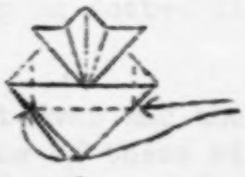
17.
Notice that the bottom half of the folded paper has two thicknesses.



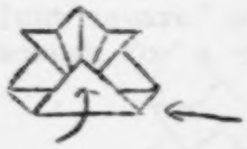
Take hold of this one.

☐

18.



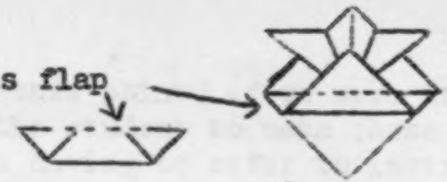
Fold it up on this line, which meets the two folds you made on the sides.



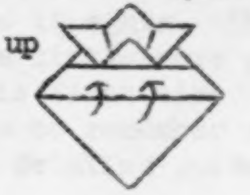
Fold and crease.

☐

19.
Now this flap



is to be folded up
like this



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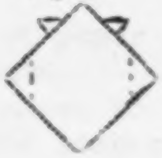
20.
Now turn the whole object
over like this



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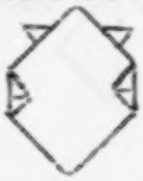
21.
Remember when you folded back the two side corners and then straightened them again? Well, now fold the two sides toward you on the same line you folded before.



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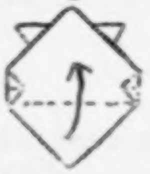
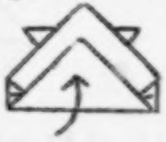
22.
Now fold up the bottom part like this





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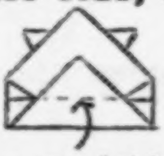
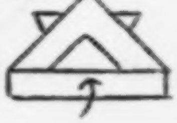
23.
One more fold, like this

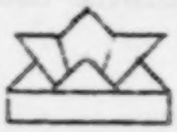




Fold up on dotted line.

☐

24.
Turn it over and there's your helmet. Make one of these with a sheet of newspaper (cut square) and you have a helmet large enough for a child to wear.



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25.
Now at this point, if we were trying to teach the student to make these helmets without having to refer to instructions, we'd have him do it again. This time we'd

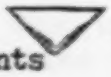
___a. Give him a little more guidance than we did this first time.
___b. Expect him to remember some of it.
___c. Give less detailed guidance.

25)
b and c.
Remember in a good program the amount of help decreases.

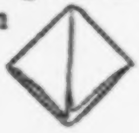
26.
Like this:
Get another piece of paper and trim it off to make it square.
(If this sequence moves too fast, you may look back at the longer sequence.)

☐

27.
Lay the sheet in front of you and fold the top point down.



Then fold the side points down to the bottom point.



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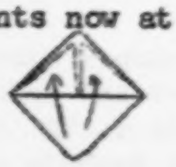
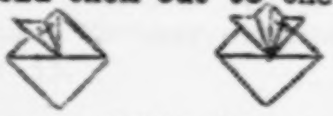
28.
Fold the two points now at the bottom straight up



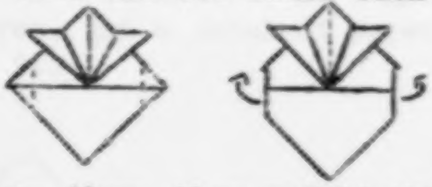
Now fold them out to the side like this



Crease all folds with your finger nail.

☐

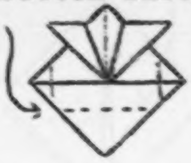
29.
Now fold the two sides back like this



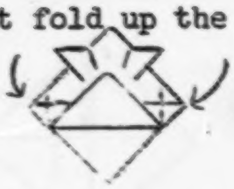
Crease them, then unfold them again.

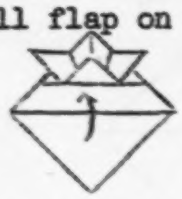
☐

30.
Pick up one of the two bottom sheets and fold it up on this line



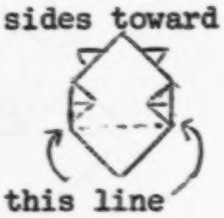
Next fold up the small flap on this line.



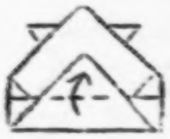


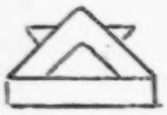
☐

31.
Now turn it over, fold both sides toward you



Fold this bottom flap up on this line





Now fold up this flap like this

Crease all folds with your fingernails.

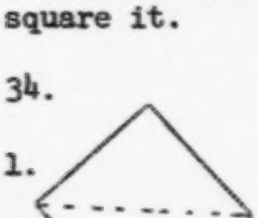
☐

32.
The second time through required only six frames, rather than the twenty it took the first time! After these two frame sequences, the student should be able to use a simple job aid or check list without further explanation. See frame 33.

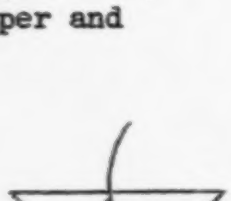
Think you can do it yourself? This third time through you'll have only a "job aid" or reference chart to follow as a reminder. To begin with, of course, get a sheet of paper and square it.

34.

1.

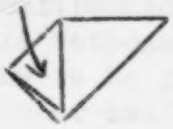


2.

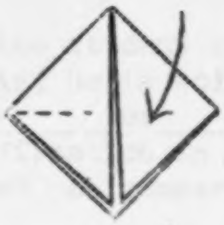


34. (continued)

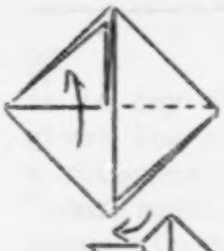
3.



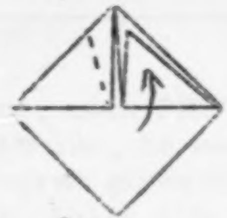
4.



5.



6.



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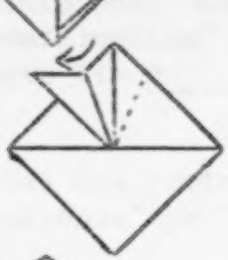

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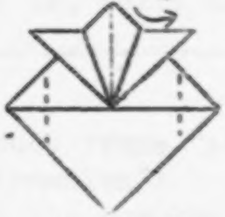
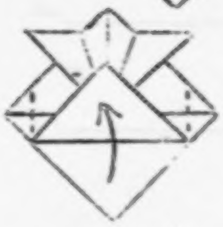
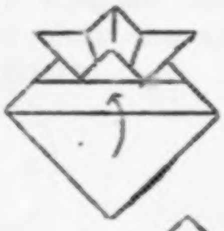


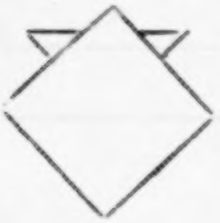
9.



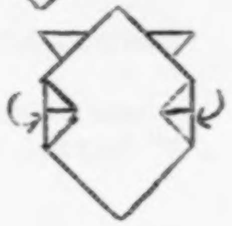
10.



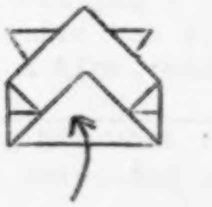
11.



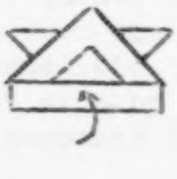
12.



13.



14.



35.
As in any program, the student is given confirmation, that is, he is told whether his response is __________or____________.
How is he given confirmation in this "paper hat" sequence? He compares *_______
____.

35)
right or wrong;
He compares his paper object with the picture or diagram.

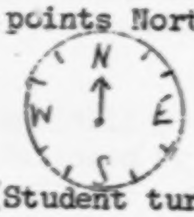
36.
As in any other sequence, each PERF frame gives the student a stimulus, he makes a response, and the program gives him "confirmation", that is, tells him or shows him *______________________________.

36)
whether he's right or wrong.

37.
Label the parts of this frame "stimulus", "response" or "confirmation":

a.____________Turn the compass until it shows that the arrow points North.

b.____________



c.____________(Student turns compass)

d.____________The arrow should now point to the letter "N".

37)
a. stimulus
b. confirmation
c. response
d. confirmation

38.
In writing a performance sequence you require the student to perform one step at a time, and give him immediate ______________after each step by showing him what should have happened if he responded correctly.

38)
confirmation

39.
Don't tell him how the whole sequence is done. Give it to him *____________
__________________and give him immediate ______________after each step.

39)
one step at a time;
confirmation.

40.
Those two principles belong in the APPENDIX on page 14. Following the words "Performance sequences" describe first how you present the material to the student, then write what follows each step. Keep the APPENDIX turned to that page.

41.
In the sample frame 37, you see that there are at least two ways to confirm the students response. You can either show him a __________ so he can see what the correct response should look like, or ________him in words what should have happened if he responded correctly.

41)
picture;
tell.

42.
A more complicated performance sequence than the origami hat might involve the use of equipment or a device. In such a case you would require the student to set up or manipulate the device. Suppose the result of his response were a change in volume. You couldn't confirm his response by *________________________, so you would have to *________________
______________________________________.

42)
showing him a picture;
tell him what should have happened as a result of his response. (Tell him how the volume should change)

43.
On page 14 of the APPENDIX you just wrote that each step is followed by confirmation. Now you can add two ways to confirm a performance response.

44.
In a sequence of this sort, you can't go on to the next step until the present step is completed correctly. This is because the material is presented *________
____________________________(how)
rather than telling you how the whole sequence is done.

44)
one step at a time.

45.
The fact that you can't go on to the next step provides additional confirmation and guidance. If you're correct, you can go on, but if you've made a mistake, you have to stop and correct the error. In some cases you may have to start over, as in the ________________type of sequencing.

45)
washback.

46.
To review: there are three types of adaptive sequencing, which are:
(1) washback, which means that * ______
____
______________________________________;
(2) bypass, which means that * ________
____
______________________________________;
and (3) branching , which means that
* ____________________________________
______________________________________.

46)
check your answers with your explanations in the APPENDIX, page 13.

47.
As in almost every programmed sequence, after the student responds in a performance sequence, the program gives him
________________________ of his response.
Two ways the program can do this are:
(1)* _________________________________
__________________________ ;(2)* _______
______________________________________.
______________________________________.

47)
check your answer with your notes in the APPENDIX, page 14.

48.
Now let's go on to what we call "preparing objectives" -- the five steps that must be accomplished before you ever write a frame. These steps include writing objectives and criterion items as well as preparing outlines to guide your frame writing. The first step, you learned long ago, is to write (broad/very precise)
______________ statements of the objectives.

48)
broad.

49.
Disregarding a slight difference in the form of the items, the list of criterion questions for the criterion test is the same as the list of criterion frames. The second step is to prepare this list of
_________________ questions, one for each
basic ___________________ of the program.

49)
criterion;
objective.

50.
Step 1: * ______________________________
______________________________________.
Step 2: * ______________________________
______________________________________.

50) 1: write broad statements of objectives; 2: write list of criterion items (questions, frames).	51. Here is another step we haven't discussed yet. You remember that every frame must have a key ______________ to which the student makes a relevant ____________________.
51) stimulus; response.	52. Another step is the preparation of an "S-R table". "S-R" stands, of course, for the frame elements, the __________ and _________________. Three steps in preparation of a program are: 1.______________________________ 2.______________________________ 3.______________________________.
52) stimulus; response; 1. objectives 2. criterion frames 3. S-R table.	53. The preparation of an S-R table consists of setting down every ______________ and _________________ in the frames leading up to each criterion frame.
53) stimulus; response.	54. Let's build an S-R table. This first time we're going to do it backwards. We're going to reconstruct an S-R table from a completed sequence. Take out the sequence you wrote on the M-D pyramid.
	55. Take a full size blank sheet of paper. Draw a vertical line down the middle of the sheet of paper dividing it into two equal size columns. Lay it beside the M-D pyramid sequence. (NOTE: frames 54 and 55 that you just completed required performance.)
	56. At the top of the left hand column, write the word, "STIMULUS", and at the top of the other column write, "RESPONSE".
	57. Now begin by writing the last criterion frame at the top of the STIMULUS column. Now think carefully. What is the first thing you want the student to do when he sees that frame?* ____________________ ______________________________ ______________________________.

57)
There are two possible correct answers. The preferred answer is: draw two M-D pyramids. Another possible right answer is: identify the two examples, calling one a division example, and the other a multiplication example.

58.
The answer we wanted was, draw two M-D pyramids, since this is required before it is necessary to identify the examples. That is the first response, so write it in the response column.

59.
What is the next response after he draws the two pyramids? We mentioned it in the preceding frame. *______________________
____________________________________.

59)
He should next be able to label each example.

60.
So the next response he should make is to label each example. Write this in the response column. Give it number 2. Write number 1 beside the first response you listed a minute ago.

61.
Now what should he do?
*___________________________________
____________________________________.

61)
see frame 32.

62.
Now he should put each example into one of the two pyramids. Here's a pretty tough question: what is the stimulus for this response in the criterion frame? Think about it for a minute. Can you guess? No - go to frame 63.
Yes - go to frame 64.

63.
Very few students bypass this frame. The question is difficult because we have not previously taught or even suggested the answer. The student who did not need to come to this frame apparently learned the answer elsewhere, before studying this program. We'll explain the answer in the next few frames.

64.
It is assumed that if you came directly to this frame from frame 62, bypassing frame 63, you were able to identify the stimulus for the response of putting the examples into the pyramids. Even so, we want to discuss the reasons for the answer. Has the student ever practiced this sequence of responses in the program?________________________________.

64)
Yes. (Check back through your program sequence if you aren't sure).

65.
In your sequence, the student always began by doing two things: identifying the given example, and drawing the pyramid. (This could be done in either order. For the purpose of columns we chose to list drawing the pyramids first.) Now, what did he always do next?*________________
____.

65)
The next step always consisted of putting an example into a pyramid.

66.
When a student practices a sequence, the completion of one response becomes, in effect, the stimulus for the next response. Considering this statement, what is the stimulus for you to hold a lighted match to your cigarette? The completion of the act of *____________________________.

66)
lighting the match.

67.
And what is the stimulus for lighting the match? There are two possiblities here, depending upon the sequence that you follow. One is: completion of the act of putting the cigarette into your mouth. The other is: completion of the act of *___________
____.
(Hint: you would complete both of these before lighting the match.)

67)
opening the book of matches.

68.
Either of the two responses described in frame 67 could be first. The first would be the stimulus for the second, which would then be the stimulus for the response of lighting the match. Can you think of any responses that would come even earlier in the cigarette sequence? Name any one.
*____.

68)
Taking out (or mooching) a cigarette (or, taking out a book of matches, or, looking for a cigarette or match, etc.).

69.
Let's put it into the form of a general statement. If the student practices a ______________ of responses, the ________________ of one response will act as the ____________ for the next ____________________.

69)
sequence;
completion (or, consequences);
stimulus;
response.

70.
Now produce the entire constructed verbal response by yourself, explaining what happens as a student practices a sequence of responses under the guidance of the program. *____________________________
____.
____.

70)
Check frame 69 and the sequence from frame 66 through 69.

71.
Now you can answer the question that was asked in frame 62. In the criterion question, what is the stimulus for the response of putting the two examples into the pyramids? *______________________
____
____.

71)
Completion of two other responses: drawing the pyramids and identifying the examples.

72.
After drawing the pyramids, it is necessary that he identify the examples because a division example is a stimulus for a different kind of response than a multiplication example. What is the difference in the two kinds of responses?*___________
____
____.

72)
Each example is put into the pyramid a different way.

73.
So the third response to the criterion frame is to put the examples into the pyramid. Make that number 3 in the response column opposite the criterion frame stimulus.

74.
What is the fourth and last response you want the student to make to the criterion frame?*______________________________
____
____
____
____.

74)
$V = IR$, $R = \frac{V}{I}$,
$S = \frac{Q}{T}$, $T = \frac{Q}{S}$
(to write the other examples from the pyramids, solve the equations).

75.
Put the student's response in the response column, as number 4.

76.
Now that you have determined your response objectives, you have to find ways to elicit those responses from the student. In the criterion frame the stimulus for drawing an M-D pyramid was just seeing a multiplication or division example. What was the first time it appeared in the sequence?
*____
____.

76)
"Draw an M-D pyramid".

77.
Write "Draw an M-D pyramid" in the stimulus column, and opposite it put the appropriate response in the response column.

77)
The appropriate response is the triangle, drawn correctly.

78.
The next response was to identify the examples. Put the next two stimulus-response pairs into the columns. Look at your first few frames to see what stimuli you used for labeling responses.

78)
In the S-R table:
S: $A = BC$. What kind of an example is this?
R: Multiplication ex.

S: $B = \frac{A}{C}$ What kind of an example is this?
R: Division example.

79.
The third response was to put the examples in the pyramids. In the response column write the procedure he would follow to put a division example into a pyramid. Use

$$A = \frac{B}{C}.$$

79)
R: Put A into the bottom left block of pyramid. Put B into top block, and C into remaining block.

80.
The stimulus for that response was a division example, and directions to put it into a pyramid. Using $A = \frac{B}{C}$ put that stimulus in the table.

80) In S-R table: S: A = $\frac{B}{C}$. Put this example into the M-D pyramid.	81. Looking at your M-D pyramid sequence, you see that before you presented the student with the stimulus you just wrote, you spent several frames teaching that one letter over another means that the _______letter is to be ______________ by the *_____________________________.
81) top; divided; bottom letter.	82. Because that response was not required in the criterion frame, (i.e., was not an objective of the sequence) but supported an objective, we call it a ____________ response.
82) supporting.	83. So a response that is not an objective may be taught as a foundation or aid in teaching a response that is an objective. The "non-objective" response is a ____________ response, and the S-R pair it is a part of is a ______________________S-R pair.
83) supporting; supporting.	84. Tuck that information away for a minute while we continue with the basic S-R pairs. The next S-R pair parallels the last -- putting a multiplication example into a pyramid. Write the stimulus and response in the appropriate column.
	85. The two basic S-R pairs remaining concern writing multiplication and division examples from a pyramid. Each stimulus is a pyramid with letters in it, and directions. Each response is an example plus a description of the procedure. O.K., put those last S-R pairs in your table.
	86. You have noticed the supporting response that helps teach the student to put an example in the pyramid (frame 81). What are the supporting S-R pairs that help teach him to write examples from a pyramid?*_________ ____ ____ ____ ____ ____ ____ ____.

86)
Supporting S-R pairs
S: Write a multiplication example.
R: $Y = KP$
S: Write a division example.
R: $C = \frac{M}{F}$.

87.
Write "Supporting S-R pairs" under the last pair you wrote, to label the sets you are about to enter. Now find and put in the S-R table five supporting S-R pairs. Before each one, in parantheses, put the number of the objective it supports.

88.
This S-R table is a basic list of all the S-R pairs (or, S-R connections) to be established by the program. Open the APPENDIX to page 5 and compare your S-R table with the one shown there. Correct yours if necessary, then save it!

89.
Read "NOTE" at the bottom of page 5 of the APPENDIX. Does your S-R table represent the teaching sequence?________. Briefly explain what the sequence in your S-R table does represent.*________________________
____.

89)
No; The sequence represents the order of steps the student must follow in using the pyramid. (or words to that effect)

90.
We can specify a teaching sequence by writing a second, modified, S-R table. It is simpler to merely outline the teaching order of S-R pairs, or mark the order of presentation on our original S-R table. Briefly name these three ways to specify the teaching sequence of S-R pairs:
(1) *________________________________;
(2) *________________________________;
(3) *________________________________.

90)
1. new S-R table;
2. outline;
3. mark (renumber) original S-R table showing teaching sequence.

91.
Specifying the teaching sequence of S-R pairs is the last of our five steps in preparing objectives. Turn to page 2 in the APPENDIX, titled "Procedures Followed in Writing Objectives". Beside step 5 write the name of the step and three possible procedures. The first order of business in Chapter Twelve will be to complete page 2 of the APPENDIX.

DISCUSSION FOLLOWING CHAPTER 11.

The determination and specification of objectives is not an easy job, and it is so important that it can not be done in a haphazard or careless way. Some programmers estimate that half of the work producing a program is spent working on objectives, specifying S-R pairs, arranging the teaching sequence, and getting ready to write frames. The frame writing and the tryout and revision process take less time than the initial preparatory work on objectives! So don't skim over your work on the objectives in a hurry to get to the actual frame writing.

The next chapter will put you off on your own for some rather extended work on objectives, without always giving you the immediate confirmation that you have gotten used to. At this point, if possible, in a course in programming, we would rely heavily on the instructor to work with you, answer your questions, edit your material, and offer suggestions. This adaptability of the instructor is something that we have not learned to approximate in our programs. Are you surprised that we indicate that the instructor would be more effecient than the program in handling this particular kind of task? For certain types of instructional objectives an instructor would be best, for others a film, a demonstration, a program, a textbook, or some other form of instruction might be the most appropriate! We're not trying to replace instructors: we're trying to contribute to a technology of instruction. Programmed instruction in the form that you are using it now is only one part of such a technology.

Now before we go on, answer these questions just to be sure that you got the points that we were trying to make. Which generally requires the most time and effort? Writing the frames or preparing the objectives and other preparatory materials, or testing and revising the program until it works. *____.

If you had any doubts about the answer, or if you said anything except working on objectives and related documents, then go back and read all of that preceding discussion material again!

Answer these questions either YES or NO.

1. Can a teacher ever be more effective than a program? _______________.
2. Is adaptability an important part of effective instruction, whether by teacher or program? ____________________.
3. When you finish this program, should you expect to be able to write programs without further help? ____________________.
4. Will we provide immediate confirmation for you as you work on objectives in this unit? ______________________.

If necessary, go back and re-read the material in order to be sure that you know the correct answers, and why they were correct! Then go on and begin Chapter Twelve.

CHAPTER ELEVEN POST TEST

1. Describe two ways to provide confirmation in a performance sequence.

2. List and describe the first two steps of preparing objectives for programming.

3. Name and briefly describe the two S-R tables that number among the five steps of preparing objectives.

4. What part of writing a program generally takes the most time and effort, writing frames, preparing objectives or testing and revising the program until it works.

5. What becomes the stimulus for each succeeding response as a student practices a sequence of responses under the guidance of a program?

ANSWERS TO CHAPTER ELEVEN POST TEST

Question	Answer
1.	Frames 41 - 42
2.	Frames 48 - 50
3.	Frames 89 - 90
4.	Discussion
5.	Frames 69 - 71

PRE-TEST CHAPTER TWELVE

1. List in order the five steps of preparing objectives.

2. Criterion test questions generally take one of what two forms?

3. What relationship is there between the response-class of your objective and the type of criterion question you write?

4. What is the purpose of the criterion test?

5. When may you revise any of your five steps?

UNIT III CHAPTER TWELVE

In Chapter twelve you will continue the study of procedures followed in preparing objectives. You will first complete page 2 of the APPENDIX, outlining the five steps.

	1. Now let's back up a couple of steps to the original M-D pyramid sequence. Is this an adequate statement of the objective? ________. "Student must understand how to use the M-D pyramid". Why? *____.
1) No; Because it does not state what the student must do; the word, "understand" does not identify behavior.	2. How about this statement? "Student must be able to draw the M-D pyramid, put multiplication and division examples into it, and then use the pyramid as a guide to write all possible equations represented by the letters in the pyramid". Adequate? ________. Why? *____.
2) Yes; It does describe what the student must do.	3. The first step is to write a set of ____________ statements of the objectives. The second step is to write the *________________, at least one question for each *________________________.
3) broad; criterion test (criterion frames, test items, etc.); objective of the program.	4. Step 1: Write *________________________________ Step 2: Write the *________________, a list which contains at least *________________________.
4) broad statements of objectives; criterion frames (or questions); one question for each main objective.	5. Next we write a narrative description or explanation of the entire procedure or content. We might be able to use good textbooks for this purpose. On the back of the S-R table you wrote, write a narrative explanation of the whole process; put down everything you'd say if you had to tutor a student to teach him the objective stated in frame 2.

5)
Compare your narrative explanation with the one on page 4 of the APPENDIX.

6.
The narrative outline should always be written before the S-R table, and after the criterion test. The first four steps, in order, are:
First: *________________________,
Second: *________________________,
Third: *________________________,
Fourth: *________________________.

6)
1st: broad statement of objectives;
2nd: criterion test;
3rd: narrative outline (explanation);
4th: S-R table.

7.
Now turn to page 2 in the APPENDIX. The title at the top of the page is, "Procedures Followed in Writing Objectives". Beside number 1 write a brief explanation of step 1. Use the information in frames 3 and 4 and their correct answers to help you explain this step.

8.
Step 2 is the criterion test. Write it beside "Second Step", and explain briefly what it should contain. Refer to frame 4, if necessary.

9.
Beside "Third Step" write "Narrative Explanation" and explain what this means. Use frame 5 for assistance, if necessary.

10.
In the next space write "Prepare S-R table" and then explain what an S-R table is and how it is to be prepared. If necessary, you can refer back to earlier frames in this unit, and to page 5 in the APPENDIX.

11.
The next step, step 5, is to set up a teaching sequence. The S-R table should show every foreseeable objective, but even so, the objectives might not be arranged in a good *____________________ ________________. You have already written the name of this step, and some notes about procedure.

11)
teaching sequence.

12.
The sequence should proceed systematically from the student's existing repertoire, and work toward the desired end product. As you can guess, we generally put the more ___________objectives before the more _____________objectives. In your own words add this information to step 5.

12) familiar (simple, easy, etc.); complex (difficult, etc.).	13. You may have wondered about the fact that in this program we sometimes use incomplete sentences, and sometimes ask direct questions. This frame illustrates the use of an *____________________.
13) incomplete sentence.	14. There are a couple of reasons for using incomplete sentences most of the time. Generally we save words, and so do you. For example, using incomplete sentences we have you practice: This booklet is a kind of teaching machine that contains a ____________. The method is called *____________________.
14) program; programmed instruction.	15. If we asked questions, we'd have to say: What does this booklet-type teaching machine contain? ____________. What do we call this method?*____________________.
15) A program; Programmed Instruction. (A complete statement would say, "We call this method programmed instruction".	16. We can generally write cue, copy, and practice frames more efficiently in the form of *____________________. In criterion frames, however, we could write either *____________________ or ____________________.
16) incomplete sentences; incomplete sentences; questions.	17. In a performance sequence, such as the M-D pyramid sequence, criterion frames may also be in the form of instructions to do something. Part of the broad statement of objectives is "student must be able to draw the M-D pyramid". The criterion frame for that objective would be in the form of ____________. Write the frame that would produce the desired performance:

17) instructions; "Draw an M-D pyramid" (and you should indicate a place for the student to do so, as we did in the preceding frame.).	18. We said once before that a list of criterion frames would be almost the same as a list of criterion test questions. The difference is that criterion test questions are rarely incomplete sentences. This means that, like criterion frames, test items may be ______________ or ________________; but unlike frames, test items generally are not *__________________________________.
18) questions; instructions; incomplete sentences.	19. So, as the second step in preparing objectives, we write a list of criterion test questions, some of which take the form of ____________, while some are ____________________.
19) questions; instructions.	20. One more point about criterion test items before we write some. Your criterion test question, like a criterion frame, must call for the same kind of response required by the teaching sequence. If you program a performance objective, calling for performance responses, your criterion test question must also call for a ____________________response.
20) performance.	21. By the same token, the test item for a discrimination sequence must be a _________________question; and a short essay could be the kind of response called for in the criterion test if the objective is a _________ (DISC, CVR, PERF) objective.
21) discrimination; CVR.	22. The type of objective determines the form of criterion test question; the type of question should always *________________________________ _________________________________.

22) call for the same type of behavior the sequence does (require the kind of behavior that makes up that objective, etc.).	23. And, of course, if you change your mind about the class (DISC, CVR, PERF) of an objective, for example, decide that the student must make a written response rather than mere discrimination, you must also change *________ ________________________________ ________________________________.
23) the criterion test question for that objective (from DISC to CVR, in this case).	24. On page 2 of the APPENDIX, Step Two, add to your notes the information about the influence of the type of objective on the type of criterion question you must use.
	25. Since the M-D pyramid sequence is largely performance, most of the criterion test questions will require __________________responses. In that case, the test items will probably be in the form of __________________ (questions or instructions).
25) performance; instructions.	26. Look at the broad statement of objectives in frame 2 of this chapter. Write a criterion test item for the first objective mentioned in that statement.
26) 1) Draw an M-D pyramid.	27. Next the statement says the student must be able to put multiplication and division examples into the pyramid. Write the questions that test that objective. (Don't forget to give him the examples and tell him to draw the M-D pyramid.)
27) 2) Draw a pyramid and put this multiplication example into it: $J = KT$; 3) Draw a pyramid and put this division example into it: $P = \frac{D}{G}$.	28. In writing a test, unlike writing frames, you have to be careful not to give away the answer to any question by including part of the answer in another question. Why din't you provide an M-D pyramid for the student in the second and third questions? *________________________________ ________________________________.

28) Because he could have copied it as he answered question one.	29. Now you need to test the student's ability to "use the pyramid as a guide to write all possible equations represented by the letters in the pyramid". Write as many questions as it takes to test this objective.
29) 4) Draw an M-D pyramid. Put M into the top block, F into the bottom left hand block, and P into the bottom right hand block. Write the multiplication example represented by this pyramid. 5) Use the same pyramid you used in the last question. Write the division example, F = ?. 6) Using the same pyramid, write the other division example.	30. On the left you see the three questions we wrote to test the objectives outlined in frame 29. Of course, there are many correct answers to that frame. But why write so many criterion test questions? We could test the student's ability to use the pyramid with only one, such as the question in the criterion frame ... and if the student succeeds, the program succeeds. Why do we need more than 1 question to test this simple objective? * __________ ____ ____ ____. ____.
30) see frame 31.	31. You test every objective in the program so that if the student doesn't master the objectives, you know in what area the program is inadequate. The purpose of the criterion test is not to evaluate the student, but to evaluate the __________.
31) program.	32. After we test the program, revise it, re-test it, and so on, until it satisfactorialy produces all of its objectives, we can throw the criterion test away, since its main purpose was to *__________ ____.
32) test the program (find weaknesses in the program).	33. Turn to the APPENDIX, page 3, where you will find a sample criterion test by "STEP TWO". The test on page 3 covers not only the objectives of the sequence, but also all the supporting S-R pairs. With such a detailed criterion test, the programmer could pinpoint any difficulty to almost the very frame which failed to do its job.

34.
All right, now we have completed the first four steps in the preparation of our objectives, so we can begin step 5, which is *________________________________

____.

34)
specify teaching sequence.

35.
Turn to the S-R table on page 5 of the APPENDIX. The first entry in the stimulus column represents the content of the ______________frame. Would it adequately represent the content of frame 1? ______________.

35)
criterion;
No.

36.
The S-R table starts with the criterion frame and the rest of the table spells out in detail the S-R pairs necessary to respond adequately to the criterion frame. Could we specify the teaching sequence simply by starting at the bottom of the S-R table and working up toward the criterion frame?

Yes - go to frame 37.
No - go to frame 38.

37.
A good look at the S-R table would make it clear that "Yes" is the wrong answer. Our S-R table is simply a list of S-R pairs that we must include. No teaching sequence is implied by the order in which the pairs are arranged. You should have been able to see that! Go on to frame 38.

38.
Right! The S-R table does not show the teaching sequence, either forward or backward. We must write a new sequence instead of using either of the other two options you wrote in Step Five. There are many possible sequences, but all must follow the principle of working from the ____________to the

_______________________.

38) simple to the complex (easy to the difficult, or known to the unknown, etc.).	39. Let's review a couple of things that you should remember that should help you to develop effective teaching sequences. The first point you just mentioned in the preceding frame; that the sequence should move from *______________________________ ______________________________.
39) the simpler stimulus-response pairs to the more complex stimuli and responses (etc.).	40. Another principle says that a program should consist of a sequence of *______________________________.
40) small steps.	41. The sequence of small steps should start with the most ____________responses, and the program should provide a lot of ________________________.
41) simple; assistance (help, guidance).	42. All right, now turn to page 6 of the APPENDIX and there you will see the teaching sequence we used when we guided you through your writing of the M-D pyramid frames. Are the S-R pairs in the teaching sequence exactly like those in the S-R table on page 5? __________.
42) No, not exactly.	43. So we can change the content of the S-R table when we build the teaching sequence. Why are we allowed this flexibility? (If you aren't sure, guess, the answer is fairly obvious)*________ ______________________________ ______________________________ ______________________________.
43) Why not? You wrote the contents of the S-R table, so there is nothing untouchable about it. If you feel, at any time, that you can improve any of the work you've done, go right ahead.	44. The criterion test, the S-R table, the teaching sequence, and even the draft set of frames themselves, all are subject to the same rule. If at any time you feel that you can make an improvement, you may feel free to *__________ ______________________________.

44)
change, revise, modify, expand, (etc) the work you have done up to that point (or any words to that effect).

45.
You are never bound strictly by the product of any of the five steps, except perhaps the first step, because your finished program, to be any good at all, must *______________________________.

45)
achieve its objective.

46.
If there are any reasons for revising your S-R table, or your narrative outline, or any other document, go ahead and change, or revise. The documents must be kept flexible. Helpful, but flexible. Now, in your own words, summarize the point we're making here.
*______________________________
____
______________________________.

46)
See frame 47.

47.
No matter how you say it, the main point is that these procedures are designed to assist you in writing programs, not to limit or restrict your work. When changes are helpful, go ahead. Now, in the space at the bottom of page 2 of the APPENDIX, write this principle in your own words.

48.
Following this frame you will find a short article on the purification of water. You are going to write a sequence covering this information. Consider your students to be average American high school students. Using your APPENDIX, pages 1 - 6, as a reference, prepare your objectives. After you finish the five steps, return to frame 49 of this chapter. You may refer to any earlier chapters of this program for assistance.

CHLORINATION

Water can be purified for drinking by chlorinating it with a household bleach solution. Make sure that the bleach you buy for this purpose is a liquid bleach of the sodium hypochlorite type. Labels of many such household bleaches include instructions on how to use them to purify water.

If the label does not carry any instructions for purifying water, use about 10 drops of bleach to a gallon of water.

Mix the water and bleach solution thoroughly and let it stand for 30 minutes. After that time you should still be able to smell a slight chlorine odor. This odor shows that the water is safe to use. If there is no smell of chlorine, you should again treat the water with the same amount of bleach as before and let it stand for another 15 minutes before you use it. The taste or smell of chlorine in the water is a sign of safety. It is not harmful. If you cannot detect chlorine by this method, do not drink the water. The bleach may have become too weak.

(from Family Guide Emergency Health Care, 1963, U.S. Departments of Civil Defense, and Health, Education and Welfare, Publice Health Service.)

49.
That was a large assignment, and we won't be able to offer nearly as much confirmation as you have received previously in this program. (Those of you who came to this frame before writing the preparatory documents are peeking ahead. Go back to frame 48 and follow directions.)

50.
You had to decide, first of all, whether your broad objective was to be performance or constructed verbal responses ... your choice was whether the student should be able to "do" or "state" (say, etc.) certain things.

51.
For example: Student will be able to describe the process of purifying water with household chlorine bleach. His description will include the type of bleach to use (sodium hypochlorite), the amount (10 drops per gallon of water or according to bottle directions) and this process: Mix solution thoroughly, allow it to stand 30 minutes. If it doesn't smell like chlorine, add the same amount of bleach and let it stand 15 more minutes. If you cannot taste or smell chlorine in the water, don't drink it.

52.
A sequence with a performance objective would have a broad statement of objectives something like this: "Student will be able to purify water with a household chlorine bleach by this method (specify method). He will be able to state that the only kind of bleach to use for this purpose is a sodium hypochlorite type household bleach.

53.
Your next step, after writing the broad statement of objectives, was to
*______________________________________.

53)
write the criterion test.

54.
Of course, if your objectives are performance objectives, your criterion test questions must require ______________ responses. And if you decided to call for constructed verbal responses, your test items must *____________________
______________________________________.

54)
performance;
require constructed verbal responses (call for essay or verbal answers).

55.
As you might imagine, a performance sequence with 30 and 15 minute waiting periods, and "ifs" that indicate more than one course of action must be programmed and tested, is impractical outside of a laboratory situation. If this program consisted of nothing but performance responses, the student should go through the process twice for the criterion test, once with a weak bleach solution that won't work, and once with a fresh solution.

56.
Probably a performance sequence would also include some DISC's and CVR's. In that case you would ask him to describe what he would do if the bleach had (or hadn't) worked the first time, etc. Here's a sample criterion test for those who are writing a CVR sequence:

1. What kind of bleach can be used to purify water?
2. How much bleach do you use?
3. How long does it take?
4. How can you tell if the water is pure?
5. What can you do if it's not pure after your first attempt?

57.
It is always important that we test every objective. In the M-D pyramid criterion test we needed many questions because we couldn't tell from omissions or mistakes what inadequacies in the sequence had caused the error. In a CVR sequence, however, omissions or mistakes in an essay question are easily identified. For this reason we could test the "purification" sequence with just two questions:

1. What kind of bleach can be used to purify water?
2. How do you purify water with household bleach?

58.
Step three is the narrative explanation. You could use the narrative given, or, if the objectives weren't clear, write a new narrative that more exactly described the objectives of your program.

59.
Step four is the S-R Table, Student Sequence. Our "purification" sequence is the kind of series of responses in which one response to one stimulus is the stimulus for the next response.

S-R TABLE, STUDENT SEQUENCE

Stimulus	Response
(criterion frame) How do you purify water with household bleach?	Put 10 drops of bleach in a gallon of impure water.
(After adding 10 drops of bleach)	Wait 30 minutes.
(After 30 minutes)	Sniff it to see if it smells like chlorine.
It smells like chlorine.	It's safe to drink.
It doesn't smell like chlorine.	It's not safe to drink.
(It's not safe after first try.)	Add 10 more drops.
(After adding second 10 drops)	Wait 15 more minutes.
(After 15 more minutes)	If it smells like chlorine.
It doesn't smell like chlorine after second try.	The bleach is to weak to use for purifying water.
Type of bleach that can be used for purifying water.	Sodium hypochlorite.

60.
Step five is arranging the teaching sequence. With a series of responses such as this one, it is most logical to begin the sequence by teaching the first step and ending with the last. (There is another technique, called "chaining", that starts at the terminal end of the sequence and then works back to the beginning of the sequence, one step at a time. This is a special purpose technique best suited to motor performance sequences, and we will not deal with it in this program). There are also facts which may be taught at any time. We'll teach them first.

S-R TABLE, TEACHING SEQUENCE

Stimulus	Response
You can purify water with	Sodium hypochlorite type household bleach.
The water smells or tastes of chlorine	it is pure
The water doesn't smell or taste like chlorine	it isn't pure
To purify water with household bleach, you first	put 10 drops of bleach in a gallon of impure water.
(After 10 drops) then	wait 30 minutes.
(After 30 minutes) then	see if it smells like chlorine.
If it doesn't smell like chlorine after first try	add 10 more drops.
(After second 10 drops) then	wait 15 more minutes.
(After 15 minutes) then	see if it smells like chlorine.
If it doesn't smell like chlorine after second try, this means that	Bleach is old, too weak to use for purifying water.

61.
Look over your five steps, revise them if you feel they need it, but don't copy the samples. These are nothing more than examples of one of the many adequate ways of preparing objectives. Save your objectives so you can write the programmed sequence from them later.

DISCUSSION FOLLOWING CHAPTER TWELVE

Efficiency

There is always a question of how many frames to write for the first version of the program. How many frames does it take to teach a given concept, principle or procedure? The question is impossible to answer, although there are a number of considerations.

First of all, a number of examples of a concept are necessary so that the student responds to the concept in a range of applications. He should have the opportunity to apply it himself in at least a few instances. The RULEG process of systematically using examples and varied statements of the principle will help you teach generalizations and concepts.

Here is a second consideration concerning the number of frames needed. If you write too few, of course, the student will not learn adequately. If you use too many, it is inefficient -- you can easily bore the student and waste his time. There are ways to find out that you wrote too few frames. The tryout student misses frames and test questions. There is no way to discover that you included too much repetition and practice. If you write too many frames, the student will learn all the objectives, but will probably not tell you that the program was dull and tedious -- that he wanted to throw it out the window.

The general rule for efficiency is "WRITE SHORT". This means that you should write a sequence that contains what you believe is an adequate but minimum number of frames to achieve its objective. The success or failure of your first tryout student will tell you whether it is too short. If a good student has trouble, you can use that information to revise frames, add frames and otherwise improve the sequence. Regardless of how well or how poorly the student handles the sequence, you are not going to discover anything about which frames are unnecessary or whether the sequence is too long.

Only experience in writing sequences and obtaining feedback from students will help the beginning programmer solve the problem of number of frames and size of steps.

We do not know, in spite of a good deal of psychological research on the subject, just what constitutes a "bit of information" or "step". We try to follow a rule that says to present only one new "thing" in a frame, but it is difficult to define what this constitutes. Does it mean only one new response word, or a single stimulus characteristic, or what? Sometimes we will try to do too much in a frame. At other times we will fractionate an objective too much and do less than could be accomplished in a given frame or sequence.

Both the problems of step size and number of steps or frames can be solved only by using your "intuition" (try to define that in behavioral terms) coupled with the results of your tryout students.

Questions

1. What two things do we have to consider in determining the number of frames needed to teach an objective?

2. What is the general rule for efficiency governing the number of frames presented to the first tryout student? What is the reason for this rule?

3. How do we decide whether a "step" or bit of information is too large or too small to be taught in a frame?

After you have answered these questions and the post-test questions, go on to the narrative review of Unit III at the end of the program, just before the APPENDIX. Read it and then return to Unit IV.

POST TEST CHAPTER TWELVE

1. List in order the five steps of preparing objectives.

2. Criterion test questions generally take one of what two forms?

3. What relationship is there between the response-class of your objective and the type of criterion question you write?

4. What is the purpose of the criterion test?

5. When may you revise any of your five steps?

ANSWERS TO CHAPTER TWELVE POST TEST

Question	Answer
1.	Frames 6 and 11
2.	Frame 18
3.	Frame 22
4.	Frame 32
5.	Frame 44

INTRODUCTION TO UNIT IV

In this final unit you will be on your own even more than you were in the last. If you have doubts about your work, hopefully you can get some criticism from an instructor.

The best judge of a program, however, is a tryout student. In Unit IV you will prepare objectives, write frames, edit them, and try them out on students, and revise them on the basis of your student's scores and remarks.

PRE-TEST CHAPTER THIRTEEN

1. Compare the type of discrimination a student must make at the beginning of a DISC sequence with those he is able to make toward the end.

2. What do you evaluate in the first several steps of the editing check list? With whom do you confer and what does he tell you?

3. What is the general rule about the spacing of review frames?

4. What is it important to consider as you insert review frames into a programmed sequence?

5. Name two types of review techniques.

Before you go on to prepare objectives for another sequence, and write frames, we should complete the APPENDIX.

1.
We'll begin with a review. What are the two characteristics of a discrimination frame? *________________________
____
____________________________________.

1)
A limited number of possible choices and something discriminable (unique) about the stimulus.

2.
The first frame in a DISC sequence is usually *___________________________
____________________________________.

2)
an immediate application frame.

3.
The answer to an immediate application frame is either *____________________
or a response to a ___________________
__________________question.

3)
a mathematical operation;
multiple choice.

4.
The simplest kind of multiple choice question is a choice between two possible answers, both given:

a. Sample X is ___________(larger, smaller?) than Sample Y.
b. Frame 12 is a (cue, copy?) _____________frame.
c. (Write another of these very simple multiple choice frames. Write it about a comparison of the length of the response in a criterion frame to the length of a response in a cue or copy frame.)

Write the frame here.

4)
(For example)
c. The student's response in a criterion frame is __________ (longer or shorter?) than the response to a cue ofr copy frame.

5.
Another simple discrimination question has two or more choices, but the choices are not given and the frame uses a direct question rather than an incomplete sentence.

a. How does sample X compare to sample Y?
_________________.

b. What type of frame is frame 12?
_________________.

c. (Write a frame of this type, using the same subject matter as you did in 4c.)

5)
(For example)
How does the length of a student's response in a criterion frame compare to the length of the response in a cue or copy frame?

6.
You have often met the "abc" type of multiple choice frame, in which the student must choose the one correct answer from three or more possible answers.

a. An English pound note is worth in American money about
   a. \$4.00   c. \$1.20
   b. \$2.40   d. \$ .60

b. (Write your own "abc" frame, asking about "frame 12" -- is it cue, copy, etc.)

6)
Frame 12 is a
______a. cue frame
______b. copy frame
______c. practice frame
(Be sure you didn't list "information frame" along with cue or copy frame as possible answers)

7.
A more difficult type of multiple choice question is the "double true-false" or "either, neither, both" item. The student cannot eliminate one of the answers just because another is correct. He must consider either, neither or both as possible correct answers.

a. Compared to sirloin, rib eye steaks are (a) smaller, (b) costlier. Check one:
(a)______,(b)______,both______,neither_____.

b. A program consists of (a)small steps, (b)trial and error. Check one:
(a)______(b)______,Both______,neither_____.

c. (Write your own "either, neither, both" item, choosing your own subject matter. Be sure that neither of the choices is ambiguous.)
(Write your frame on next page.)

7)
You'll have to judge your own frame. It should clearly test your objective without being vague, too easy, or tricky.

8.
The important points about discrimination frames are that the correct choices must be entirely correct and unambiguous, and incorrect choices should be equally unambiguous. Check and revise, if necessary, the four frames you just wrote, then copy them into the APPENDIX, page 14, after the words "Sample Frames".

9.
At first the distinctions in a DISC sequence are very gross, but gradually the student makes finer and finer discriminations. For example, in frame 1 he may learn the difference between nouns and verbs, but by frame 35 or 40 he might be discriminating between gerunds and verbs, a much ___________ discrimination.

9)
finer (harder).

10.
As any sequence, the DISC sequence moves from the easy to the difficult responses. As he progresses, the student makes ___________ and _____________ discriminations.

10)
finer and finer.
(finer and harder)

On the next page you will find a narrative entitled "Characteristics of Programmed Instruction". You are going to write a programmed sequence to teach this material. First, of course, you must prepare your objectives. Open the APPENDIX to page 2 and use it as a guide to assist you. Take as much time as you need. As soon as you have set up your five steps, return to frame 11 of this chapter. You may use the following narrative as your third step, if you feel that it appropriately describes the material you want to teach in your sequence. If you want to rework it to make it more interesting, or longer or shorter, go ahead.

CHARACTERISTICS OF PROGRAMMED INSTRUCTION

Certain instructional materials in book form make up a type of teaching machine, and the instructional content itself is called a "program". Instruction via a program is called, "programmed instruction", and it has certain characteristics that are designed to make it easier for the student to learn. One of the characteristics is the guided practice of correct answers, since we tend to recall those things that we actively practice. For example, if you read the names of four of the States, and practice just one of the four, you will tend to remember only the one that you practiced.

Another characteristic is small steps. The material is broken down into small steps, since even difficult material is made much easier when it is broken down into small steps, each of which the student can handle. When the student responds correctly to a small step, he is practicing the knowledge and learning it. The student needs a lot of help when he begins a topic, but as he learns more and more, he needs less and less help, so a program provides a lot of help early in a sequence, reducing the amount of help as the student learns.

A program also provides the student with immediate information as to the correctness or incorrectness of each answer he practiced. In this way the student always knows whether his answers are right or wrong. A program also lets each student proceed at his own rate of speed. The slow student will take much longer to use the program than a faster student, but each student will be able to complete the program and learn from it. Also, after the program is written, it undergoes a series of tests and revision, during which students use the program so we can see if the program teaches what it should; that is, if it accomplishes its objectives or goals.

Often we will add adaptive sequencing, which allows the program to adapt to each student, allowing each student to take the sequence or route that is best for him. A program that includes adaptive sequencing is much more flexible in meeting the needs of the entire range of student abilities. Branching, bypass, re-cycle, are examples of adaptive sequencing techniques.

One last point, about objectives. A statement of objectives that we can use in writing a program must be stated in terms of what the student must do, rather than in vague terms such as, "know", "understand", "appreciate", etc. This concept should be important to every teacher or author, since it helps specify the content that must be taught.

11.
You have just prepared the set of documents needed to begin writing frames for a sequence on "Characteristics of Programmed Instruction". You may find as you proceed that you'll have to revise your five steps a little. Don't worry about it. Let's get on to the next part of the task, writing frames.

12.
Often you will find that the first frame is the most difficult to write. If your teaching sequence and S-R table are any good, they'll let you keep going once you get that first frame written, so we're going to give you frame 1. Then you'll have to proceed on your own a bit more. Get some paper, then look at frame 13.

13.
Here's your frame 1:
This book is a kind of teaching machine. Even though it's a book, we call it a teaching machine because it is going to ________________you something.
(Note that this is a copy frame for the word "teach", and the key stimulus is the term, "teaching machine"). O.K., off you go, write at least 6 or 7 frames and then turn to frame 14.

14.
Now that you have written a few frames - at least, we assume that you are following our instructions - we're going to give you a little help to fall back on: a source of sample frames, and a source of some feedback for your work. Turn to the first frame of Chapter One.

15.
If you'll leaf through Chapter One, you'll notice that those frames deal with the same objectives that you are programming now. Use those frames to assist you where you feel that they might be of some help, but remember, don't copy and don't revise any of your paper work just to fit what we wrote into our frames for these objectives. O.K., now go on and write at least another 20 or 30 frames, working from your objectives. Then turn to frame 16.

16.
It's a little difficult and frustrating, isn't it. Use the rules, guides, and other content of the APPENDIX; that's what the APPENDIX is for. Also, refer back to any earlier units of this program. Go ahead and finish your sequence, then turn to frame 17.

17.
Now your sequence should be complete. Let's ask a couple of questions. Did you use adaptive sequencing as we did in the introduction?
Yes - go to frame 18.
No - go to frame 19.

18.
You say you did use adaptive sequencing. well, did you use it for the same topics that we did?
Yes - go to frame 20.
No - go to frame 21.

19.
You didn't use adaptive sequencing at all! Well we did in the introduction! Why didn't you? Did you have a specific reason?
Yes - go to frame 22.
No - go to frame 23.

20.
You followed our lead and used adaptive sequencing for the same topics that we did, for the discussion of adaptive sequencing and of objectives. Did you have a good reason, or did you just do it because we did?
I had a good reason of my own - go to frame 22.
No special reason except the introduction used it - go to frame 23.

21.
You did use adaptive sequencing, but for different topics than we did. Well, why not! Did you do it just for the fun of it, or did you have a specific reason for selecting the topics you did?
I had a good reason - go to frame 22.
No special reason - go to frame 23.

22.
Depending on whether or not you used adaptive sequencing, and why, you could have arrived at this frame from frame 19, 20, or 21. Or from those frames you could have arrived at frame 23 instead of this one. This frame is for those who did what they did for a specific reason. Congratulations! When programming, you should always have a reason for each thing you put into your program. Skip ahead to frame 24.

23.
Depending on what you did and why, you could be sent to this frame from frame 19, 20, or 21, and those three frames would send others to frame 22 instead of to this frame. This frame is for those who did not have a specific reason for their use or lack of use of adaptive sequencing. You should not, when programming, make casual decisions without a reason. Go on to frame 24.

24.
Actually, the frames from frame 17 up to this one were put in here for a very simple reason - to make you work a bit to put some emphasis on the need for a specific reason for using or not using a technique. We had another reason too. Look back over the sequence beginning at frame 17 just to see how we use this branching kind of adaptive technique. Then go on to frame 25.

25.
This sample of the use of adaptive sequencing is one of several included in this program as a sample or model of how adaptive methods might be used. There is a "sample" index on page 21 of the APPENDIX that will show you where to find other such examples and prototypes.

26.
Now that you've finished your frames on "Characteristics" look them over again. If they seem adequate, tuck them in a drawer for a day or two, if possible. Meanwhile, let's talk about a systematic way to edit a program.

	27. On pages 15 and 16 of the APPENDIX you see another of those flow charts. This one is titled*____________________.
27) Editing Check List.	28. The first box on the flow chart after the word "begin" says *__________________ ______________. We're going to start by re-evaluating all of our ______________.
28) Read the objectives; objectives.	29. The first thing we ask about our objectives is *__________________________________ __________________________________. (the next box in the flow chart)
29) Are they behaviorally defined?	30. If our objectives are not behaviorally defined, we should *____________________. If they are defined in terms of what the student should do, we *________________ __________________________________.
30) revise them or have them revised; have the subject matter expert review them.	31. A subject matter expert is a person who has enough knowledge of the material being programmed to be sure not only that there are no technical errors in the program, but also that the program teaches everything that should be taught. You ask your "SME" (subject matter expert), "Are the objectives *____.
31) technically correct and appropriate.	32. If your SME tells you that some of the objectives are in error or inadequate, you must ____________________.
32) revise.	33. After you get the approval of your SME, you must look over your *____________________ to be sure it *__________________________ ______________and review your ______________.
33) criterion test; tests every objective; narrative.	34. If your criterion test doesn't test every objective, you ______________. If your narrative doesn't tell, in a narrative fashion, all the objectives you are to program, then it is inadequate and you must __________________.

34) revise; revise.	35. If both the narrative and criterion test seem adequate, send them to *__________ __________. If they also seem adequate to him, you will *__________ __________.
35) the subject matter expert; keep the objectives beside you and open the program.	36. The next series of editing steps check to see if the objectives are being taught. First you re-evaluated *__________ __________, then you are to *__________ __________.
36) the objectives; check to be sure you taught them.	37. The object of the second series of editing steps is to *__________ __________. We start this process by *__________ __________.
37) make sure you taught the objectives; reading the first 25-50 responses.	38. We read the responses to see if they *__________ __________ __________. If you don't know how to tell, the first thing to look at is the *__________ __________.
38) adequately reflect the behavior called for in the objectives; first criterion frame.	39. After you find the first criterion frame, you *__________ __________, then *__________ __________ __________.
39) find the objective that the first criterion frame parallels; examine the frames preceding the first criterion frame.	40. The question you ask when you examine the frames leading up to the first criterion frame is *__________ __________? The answer to this question also answers what other question? *__________ __________ __________?

40) do the frames gradually build the student's capability to answer the first criterion frame and the objective it matches?; do the responses seem to reflect the behavior called for by the objective?.	41. If the responses don't reflect the behavior called for, you must ______________, but if the frames do gradually build the student's capability to master the objectives, you may go on to the next steps, which say *________ ______________________________________.
41) revise; read the frames.	42. When you read the frames, you ask yourself *______________________________________?
42) do they make sense?	43. You may find it hard to imagine that a program's author might have difficulty with his own frames. If you had set aside your frames for a few days, as recommended, you now might stumble over the inadequacies that would give the students trouble. If you find difficult frames, the next question is *_____________ ______________________________________?
43) can you revise them by making simple changes?	44. "Simple changes" means changing a word or rewriting one frame. Your difficulty, however, may go back several frames to a supporting response not learned or to a problem involving a whole set of frames. If your revision extends beyond a frame or two, after you revise you should begin the second part of the editing process again, starting with the box that says *____________________________.
44) read the first 25-50 responses.	45. If you don't find any frames that are difficult or ambiguous, you are directed to the box in the diagram that says *_____________ ______________________________________.
45) read through the sequence just to see if it is well written and makes sense. Is the sequence clear?	46. If you answer, No, the sequence is not clear, not interesting, you are asked, again, *______ ______________________________________ ______________________________________.

46) can you revise them by making simple changes?	47. After a simple revision within a frame, you return to the editing check list at the point where it says *____________ ______________________________.
47) read through the sequence to see if it's well written and makes sense.	48. If your revisions are extensive you start editing again at the place where the checklist box says *____________ ______________________________.
48) read the first 25-50 responses, etc.	49. If the sequence does appear to be clear and interesting, we'll check to be sure the sequence follows the major programming rules. We ask this question about each sequence, starting with the one leading up to the first criterion frame: *____________ ______________________________?
49) is each new specific word introduced in a cue or copy frame?	50. If the answer is "yes", the next checkpoint is *____________ ______________________________?
50) is each principle clarified by a number of examples?	51. And if that is true, the last question to ask is *____________ ______________________________?
51) do the steps appear to be small enough, without being so small that they only mark time without making adequate progress?	52. For some of these checkpoints you have no concrete criteria with which to judge your frames. You still should try to decide whether they seem to be interesting and in clear small enough steps. Your tryout students will give you more information about the quality of your sequence.
	53. Hopefully, by now your frames on "characteristics" have rested in the drawer long enough for you to have a more objective view of them. Take your sequence out and we'll edit it using the editing checklist on pages 15 and 16. In the first series of editing steps you will *____________ ______________________________.

53)
re-evaluate the objectives (check to see that the objectives are behaviorally defined, accurate and adequate.

54.
After you make sure your objectives are ____________ ______________, you will turn them over to "______________ ______________________________.

54)
behaviorally defined;
a subject matter expert (unless you are serving as your own S.M.E.)

55.
Your subject matter expert (probably yourself, in this case) will check to see that your objectives are both ______________ and ______________.

55)
correct (technically accurate);
appropriate (adequate).

56.
After you have re-evaluated all five steps of your objectives, come back to frame 57.

57.
The rest of the check list deals with seven questions with which you can judge whether your frames teach your objectives and whether they follow "good" programming procedures. List these seven major questions (don't count questions that only tell you what to do if you don't know the answer, or the answer is "no".).

1. ____?

2. ____?

3. ____?

4. ____?

5. ____?

6. ____?

7. ____?

1. Do the responses seem adequately to reflect the behavior called for by the objective?
2. Can you answer each frame without difficulty?
3. Is the sequence clear?
4. Does it appear interesting?

5. Is each new specific word a term introduced in either a cue or copy frame?
6. Is each principle clarified by a number of examples?
7. Do the steps appear to be small enough without being so small that they only mark time without making adequate progress?

58.
Edit your frames. Then return to this frame and we'll tell you how to go about trying them out to see if they work!

59.
The following discussion of the tryout and revision processes may seem to move very rapidly. This is appropriate because you are not to learn the content of the discussion, but simply to get ready to follow the detailed guide in the APPENDIX. In addition to practicing verbal responses, about tryout and revisions, you will then have a chance to carry out the really essential activity involved in learning how to tryout and revise your program. What do you think that "essential activity" is? *______________________________
____

59)
The essential activity in learning to tryout and revise a program is actually trying out and revising your program.

60.
The feedback you get from your tryout student will tell you a great deal about your program. Be sure that you use a student representative of those for whom the program was designed. This is one of two important principles. Briefly, the two principles are: (1) Write with a specific target population in mind, and test your program on members of that population. (2) Don't assume too much or too little about the student's present repertoire; find out from the students what they can already do. Now, briefly, why are these two rules important? *__________
____
____

60)
They are important in making your program effective and efficient. We assume they are obvious - well, because they seem obvious!

61.
Now go on to the next page to the explanation of the tryout and revision process.

TRYING OUT YOUR PROGRAM

There can be a lot of flexibility here and you may want to modify this procedure a bit. It is extremely important, however, that as a programmer you watch a student trying to learn from your edited sequence. As you go through the tryout phase you should look for any information about the adequacy or inadequacy of your frames. If a student frowns, find out why. If he makes an error, find out why. When he finishes each set of frames, talk to him about the objectives. Find out how much he learned by testing him on the objectives, then ask him to comment on the frames. Were they clear, interesting, smooth, and informative? Remember, if he makes no errors and offers no information, you haven't learned anything about your program from him. The purpose of the individual tryouts is to uncover the weak parts of the program, the poor frames, and the inadequate sequences. Don't use only the better students from the target population, or you'll learn very little. Use some of the poorest students you can find from the target group also. From them you'll learn a great deal about your program! The basic procedure is this:

1. Use five or six students, one at a time.
2. Start with a student representative of the top of the target population (one of the brighter, faster learners). If he has trouble with your program, certainly the poorer students would be in real difficulty. Get as much information from him as possible. Test him.
3. Revise, then get a second student, not quite as good as the first one. Have him go through the frames. Test him.
4. Repeat, using a student who is about an average learner from the target group.
5. Repeat using a student closer to the bottom of the group.
6. Repeat using a student representative of the poorest in the target population. After revising, repeat as many times as necessary (within limits, we'll discuss this later).

There are four pages in the APPENDIX, pages 17, 18, 19 and 20, that describe in detail the procedures you are to follow in testing, revising. Turn first to page 17. This is a check list for individual tryouts. We'll look at it first, then at the checklist for the revision process, and the flow chart. Read the eleven steps, answering these questions about the steps as you read them. Don't write the answers; answer them to yourself.

1. About how many frames should you test at one time?
2. On what basis might you test more than that, or fewer?
3. How should you prepare the frames for testing?
4. What do you have to prepare besides the frames?
5. Before he starts on your frames, what should you give him to read?
6. Exactly how is he to proceed through the frames?
7. What should you write in your notes?
8. What should you do about incorrect responses?
9. How do you test the student?

Here is your next assignment: (1) Take out your two completed sequences, on the M-D pyramid and the characteristics of "PI", and your prepared objectives for the purification of water sequence. (2) Write frames for the purification program, then put it aside while you (3) edit the M-D pyramid, (4) Next edit the short water purification program, type it on 3" by 5" cards, and try it out on a student. Eventually you will try out each of these three programs you have written.

After you have tested and interrogated your first try-out student, it will be time to revise the "test package" sequence of frames. If you remembered to write short, your sequence contains the mimimum number of frames you thought necessary to teach your objectives. It will include little, if any, review. Before we go on to revise, let's talk about review frames.

62.
Although this is another of those areas for which there are few guidelines, we all agree that if the student forgets some of the responses before the criterion test, we must insert some __________________ frames.

62)
review.

63.
And there is agreement that review frames should be inserted after progressively longer intervening sequences. For example, five frames after we finish teaching an objective we would slip in a review frame. The next review frame would come

___a. five frames later.
___b. two frames later.
___c. ten frames later.

63)
c., ten frames later.

64.
There's no need to follow any specific rule on the spacing of review. Systematic inspection of your program, to be sure that you have periodically reviewed all of your objectives, will work--if you do it systematically. If you want a general kind of review spacing method, look at this set of numbers, and add the next numbers that should follow in order.

4 8 16 ______ ______

64)
32, 64. The number is doubled each step.

65.
You might approximate a spread of this sort in spacing your review frames. If you used an arrangement like that shown above, the first review frame would appear four frames after the criterion frame for A, the second review frame _____frames later, and the next after _______ more frames.

65)
8, 16.

66.
You may find that most objectives are reviewed automatically. This happens when one objective is built upon the last. Suppose we are teaching three objectives, A, B, then C. Objective A is a basic part of B and C, so how is objective A reviewed? *_______________
_______________________________________.

66)
Objective A is automatically reviewed as we teach B and C. (Since A is part of B and C or basic to them, it is reviewed in the other sequences.)

67.
But suppose our three objectives are discrete, not built on each other. We'll use the example of A, B and C, but this time they are barely related. If we used the method described three frames ago, the first review frame for A would appear
*_______________________________________
____
_______________________________________.

67)
four frames after the last frame of A (frame 4 of the B sequence).

68.
We can review A during the B sequence in one of three ways: by adding review of A to a frame that also includes B material, or by inserting a frame that only reviews A. Does this sample sequence show the first procedure or the second? __________________________

11	12	13	14	15
B	B	AB	B	B

68)
first.

69.
What procedure does this sequence represent?

11	12	13	14	15
B	B	A	B	B

*_______________________________________
____
_______________________________________.

69) A review frame has been inserted that contains only review of A, and nothing about B.	70. If you use the procedure shown in frame 4, you must be careful to provide some sensible transition. So that the review frame will make sense, and not stand out as a seemingly irrelevant item, it is important to * ____________________ ____________________.
70) provide transition.	71. Review that last point. It applies to both ways to insert review frames. In adding review material, you must be careful to * ____________________ ____________________.
71) provide transition. (make sure it doesn't appear irrelevant).	72. We don't want to overdo it, but too much review is a bit better than too little. Fortunately we can save a great deal of time for the student by using review frames plus a set of narrative reviews. A passage of reading material in the form of a discussion, not broken down into frames, is referred to as a __________ review.
72) narrative.	73. The two types of review techniques that we've mentioned are: (1) * ____________________ and (2)* ____________________.
73) review frames; narrative review.	74. A review frame calls for a response taught earlier in the program, such as a criterion frame used for review purposes. How would you describe a narrative review? * ____________________ ____________________ ____________________ ____________________.
74) A narrative review is a discussion of material taught earlier, but not broken down into frames.	Go on to the discussion of Narrative Reviews, following this chapter.

DISCUSSION FOLLOWING CHAPTER THIRTEEN.

A narrative review might have occassional blanks or questions to be sure that the student's attention and contact with the material are maintained. An example of a narrative sequence (although it is not a narrative review sequence) that contains response requirements was used in Chapter four. You might take a look at that material now to see what we mean by a narrative form of presentation.

In the interests of efficiency, the narrative review has a lot to offer. Consider the word "efficient". There can be a very significant difference between effective and efficient. A program might be effective without being at all efficient. It might accomplish all of its objectives,--which means that it is effective--but do it in such a tedious and drawn-out fashion as to be extremely inefficient. An efficient program accomplishes its objectives and does so as rapidly and thoroughly as possible. Inefficiency can be introduced by too much, unnecessary elaboration, irrelevant, non-objective content, too gradual response development, or any of a number of other possibilities. The continual use of sets of review frames serves to lengthen programs to such an extent that a 2000 frame program designed for minimum retention past the end of the program could conceivably contain 300 or 400 frames included solely for review purposes. This 15% to 20% of the program represents a substantial investment of time and effort for both the programmer and the student. Any faster method that accomplishes the same purpose as effectively, therefore, will be of great advantage to us.

The narrative review concept, it should be pointed out, is based on certain assumptions that seem to justify it: it is not just a method arbitrarily selected to replace frame writing! Consider first the concept of associations between stimuli and responses. During the development of these associations we provide systematic guidance, showing by the use of blanks or questions, just what response the student is to make to the stimuli we present. Unless we are dealing with performance objectives, where we want the student to perform some overt action such as turning a dial, filling in a form, or manipulating a tool or device, the response we really want is a covert response. We want him to think the response that is appropriate, and when we require overt written responses we really do so only because in that way we can be sure that the thinking response did occur. After the student has learned to respond to the stimulus material and has practiced doing so a number of times, the tendency has been pretty well established for him to continue doing so even when no blanks or questions are provided. In other words, he can now read narrative material meaningfully, which is another way of saying that he responds to it, thinking responses to the stimulus portions of the narrative. Since the narrative is in the form of complete sentences, the response content is also present, so in effect the student is seeing confirmation of his thought response as he reads, and well-established associations are reviewed in an interaction between the narrative and the thinking of the student.

Initially we break the material down into small steps, thereby clearly identifying stimulus "packages", but as the student becomes progressively more competent, the need for the arrangement of individual steps becomes less, and we can lay out a complete, uninterrupted narrative. As the student learns more and more, he can respond more rapidly and with less effort to increasingly larger amounts of material. We should capitalize on this developing ability to as great a degree as possible and the narrative review technique seems to offer a great deal toward this end.

Questions:

1) What is the advantage, if any, of narrative reviews over the use of review frames alone?

2) Do narrative reviews expect active responses? If your answer is "yes", please explain what kind of responses are elicited, and how. If your answer is "no", explain why the use of narrative reviews is recommended while textbooks are criticized because they do not require active responses.

Now is the time to catch up. If you have not prepared your three programmed sequences for tryout, or have not tried one of them with one student, please do so now. Then go on to Chapter fourteen.

POST TEST CHAPTER THIRTEEN

1. Compare the type of discrimination a student must make at the beginning of a DISC sequence with those he is able to make toward the end.

2. What do you evaluate in the first several steps of the editing check list? With whom do you confer and what does he tell you?

3. What is the general rule about the spacing of review frames?

4. What is it important to consider as you insert review frames into a programmed sequence?

5. Name two types of review techniques.

ANSWERS TO CHAPTER THIRTEEN POST-TEST

Questions	Answer
1.	Frame 10
2.	Frames 29 - 31
3.	Frame 63
4.	Frame 70
5.	Frame 72

PRE-TEST CHAPTER FOURTEEN

1. What information should be published with the program for the benefit of the purchaser?

2. Name and describe the three types of adaptive sequencing.

3. How much do we guarantee the student will learn and remember of these parts of our program:

   (1) objectives programmed in frames.

   (2) discussion material.

4. How should you choose instructional media to accompany a program (or for any purpose)?

5. What three guidelines can you follow in preparing an instructional package?

UNIT IV CHAPTER FOURTEEN

In this final chapter of Instructional Programming Procedures you will complete the try out and revision processes of your three programs. We will close with a discussion of instructional media.

1.
Your first tryout student should represent what part of the range of abilities of your target population? *____.

1)
the top (one of the best students).

2.
Before the student starts the test package, the programmer gives him *____.

2)
a practice sequence (and perhaps the criterion test. See frame 3).

3.
After a program has been tested and revised and is reaching the point were it accomplishes its objectives, you may give the student the criterion test before and after the program. In this case, before he sees the test package the student would receive both *__________________
and *__________________________.

3)
the criterion test and the practice package.

4.
So that he can tell exactly how much the student learned from the program, the programmer can measure "incoming behavior" by giving the student the
*__________________________________
before the program.

4)
criterion test.

5.
And so that his first few frames won't be lost to the student who doesn't understand how to use a program, the programmer gives the student *____________________
____
________________________.(what and when)

5)
a practice set of frames before the sequence he's trying out.

Go on to the next page.

After you have completed the testing of one student, you have to revise the frames. Turn to page 18 of the APPENDIX to see how we go about this. As you read that checklist, answer these questions:
1. What do you look at first?
2. What do you do if he missed a test question, but answered the corresponding criterion frame correctly?
3. What is the only reason for changing a criterion frame that the student missed?
4. How do you revise to try to eliminate the reasons for a criterion frame having been missed?
5. How do you make revisions in the case of other frames that were missed?
6. What kind of numbering system should you use for frames that you added to the sequence?
The value of the notes you took while going through the frames with the student cannot be overestimated! Sometimes an error by itself is incomprehensible to you unless the student tells you the reasons behind his wrong answer.

This tryout and revision procedure used for one student must now be repeated. You should learn a lot about learning, about students, and about programming from that one student! These two checklists describe the procedure you'll use for each student. The checklists are incorporated into the flow chart on page 20 of the APPENDIX. Since we have already walked you through the checklists, we won't bother to take you through the flow chart. You can go through it by yourself.

There is one thing in the flow chart that we haven't mentioned yet. After you have completed the individual tryouts, you need a group tryout with 5 to 10 students, representing the whole range of your target population. The reason for this is that your individual tryout situation, with you watching him and asking questions, was quite artificial compared to the more private manner in which the finished program will probably be used. The group tryout will provide more data, and from a different kind of situation. Use the same revision procedures described for the individual tryouts. Revise and use another group tryout if necessary, and repeat as many times as necessary. Finally, if desired, you are ready for a large scale field test. In a field test the program is used by a large group of the target population, in the actual learning situation in which the final version is to be used. Take out your edited sequence on "characteristics".

Try out your sequence on at least one student. Revise it on the basis of the tryout results.

How long does this test-and-revise process go on? How do you know when your program is suitable for publication? Primarily, of course, the program must accomplish its appropriate objectives. The criteria set for this by many programmers is the "90-90" criterion. The program is successful when 90% of the students learn 90% of the objectives, as measured by the criterion tests. The students in this case must fairly represent the target population, and the program must be tried out on enough students to give these figures some validity. Information about the target population, the objectives, the test population and the data from the field tests should be published with the program. The statement of objectives and description of the target population are necessary for the user or buyer to judge whether the program fits his needs. The tryout or field test data and a description of the test population show that the program does achieve its objectives and by what criteria.

However, there are other things to consider in evaluating your program than that the objectives are appropriate and are learned by the students. If it takes longer to learn the same material with the same retention using a program than using a textbook, the program is not very useful. If the program is efficient, then it will teach almost any subject matter more quickly and thoroughly. But if your sequence contains unnecessary repetition and irrelevant material, the student will find it a dull waste of time.

But wait a minute! That doesn't mean you should discard everything that is not on the criterion test. At one time the specification of objectives meant assigning all course content to one of two places, either the program or the wastebasket. The objectives were programmed while we threw away all of the nice-to-know sidelights, applications, illustrations, humor and interest. Then later we wondered why students and their teachers considered our programs dull!

6.
Let's have some overt responses to some of the material above. If we made a checklist of what we should look for in a program, we would first ask, "What are its ____________________?"

6)
objectives.

7.
To find out the program's objectives, the user must
____a. call the programmer.
____b. read the criterion test.
____c. read the statement of objectives published with the program.

7)
b and/or c.

8.
The user, having found the objectives as stated suitable for his classroom or other purpose, now wants to know something else related to its suitability for his students. He needs to know:
*______________________________
______________________________.

8)
what is the target population? (What level of student it was written for)

9.
Like the statement of objectives, this information about the target population is necessary for the user, and so, it should be *______________________
______________________________.

9) published with the program.	10. So far we have mentioned two pieces of information that should be published with the program: (1) *________________________ (2) *________________________
10) (1)statement of objectives; (2)description of target population.	11. Another thing the buyer will be interested in is how well the program achieves its objectives. Naturally, we'll tell him. The third bit of information published with the program tells *________ ________________________________.
11) how well the program achieves its objectives.	12. That's three items, now, for our "user's manual". List them. (1) *________________________ (2) *________________________ (3) *________________________
12) (1)statement of objectives; (2)description of target group; (3)how well the program achieves its objectives.	13. A very stiff criteria to judge whether a program does its job would be "95-95". This would mean that 95% of the students learned 95% of the material. Most programmers use the "90-90" criteria, which means *______________________ ________________________________.
13) 90% of the students learned 90% of the material.	14. If we give the criterion test to our field test group, and we only reach "80-80", which means *____________________ ________________________________, we would have to revise again.
14) 80% of the students learned 80% of the material.	15. The test population is supposed to, as nearly as possible, resemble the target population. The target population is described in our information for the user, and we should also *________________ ________________________________.
15) describe the test population.	16. Some of the information the programmer provides is to show that the program does its job. He must tell *________ ________________________________ ____________________(Here's a hint: "90-90") and he must describe *______ ________________________________ ________________________________.

16)
how well the program achieves its objectives (what % of the students learn what % of the material);
the test population.

17.
The information a program buyer must be able to find in the program includes:
(1) *______________________________
(2) *______________________________
(3) *______________________________
(4) *______________________________

17)
(1) statement of objectives
(2) description of target population
(3) statement of degree to which program achieves objectives
(4) description of test population

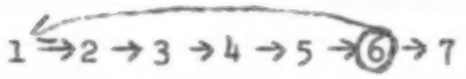
During your test, revise and retest process, suppose you find that many students breeze through your program, while others stumble and struggle along, making many errors. You will add more examples, practice frames and review frames. But why drag the better student, who had no trouble with your sequence before you added practice and review, through these extra frames?

18.
To avoid dull repetition for the better student, we may use a technique that adapts the program to the varying needs of the students. This technique is called *__________________________.

18)
adaptive sequencing.

19.
The type of adaptive sequencing that "washes" a student back from the test frame he answers incorrectly, to the beginning of the sequence again, is called ______________________.

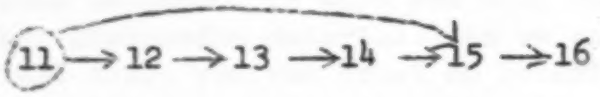
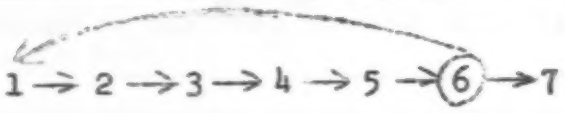
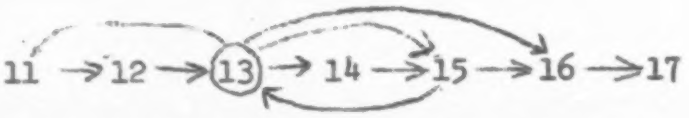
19)
washback.

20.


This is a sequence of frames. Frame 6 is a criterion frame that tests the student. If the student "fails" the test frame, the student must *________
__________________________.
This type of adaptive sequencing is called ______________________.

20)
go back to frame 1 (go through the sequence again);
washback.

21.
So if your sequence is adequate for many or most tryout students, you don't always have to add extra examples and practice, which might amount to a repetition of your sequence. Instead, you could use a type of adaptive sequencing called ________________ in which
*______________________________
______________________________.

21) washback the student who fails the test frame repeats the sequence.	22. In another type of adaptive sequencing, the better student is allowed to bypass the material he does not need. So if many students have learned an objective, either before entering or during a program, you can skip them over additional elaboration in the sequence with an adaptive sequencing technique called _______________, in which *____________ _____________________________________ _____________________________________.
22) bypass; the student who answers the test question correctly (knows the objective) is allowed to bypass the (remedial or teaching) sequence.	23.  Frames 12-14 make up a sequence containing additional explanation and practice for students who have not yet learned the objectives taught in frames 1-10. Frame 11 is a test frame. The adaptive sequencing technique illustrated is called ___________, and here's the way it works:*_____________ _____________________________________ _____________________________________.
23) bypass; the student who answers correctly, skips the remedial or elaboration sequence. (The student who misses frame 11 must take frames 12-14, but if he answers 11 correctly, he goes straight to frame 15).	24.  This represents a type of adaptive sequence called _______________, in which *_________________________________ _____________________________________ _____________________________________ _____________________________________.
24) washback; the student who fails to achieve the objective repeats the sequence.	25. We call the third technique "branching". When the test frame contains several possible answers from which the student must choose, and each answer sends the student to a remedial sequence designed to correct that particular error, then we refer to the adaptive technique as ______________________.
25) branching.	26.  Frame 13 tests the objective taught in frames 1-12. Which frame does the student go to if he chooses an incorrect answer? *_____________________________________. This type of adaptive sequencing is called ______________________.

26) The one that corrects his particular error (11, 14 or 15); branching.	27. We slipped through these frames on adaptive sequencing rather quickly, but you can probably name and describe all three techniques. Do so: *____.
27) Check your answers with frames 19, 22 and 25.	28. This sequence is a brief review of a discussion earlier in the program. We had to put this material into frames because we cannot be sure you will remember discussion material. As we said at that time, you can count on retention of objectives carefully taught in frames, but discussion and enrichment material *____.
28) cannot always be counted on to produce learning.	29. The student's responses and practice are carefully controlled in frame sequences, but not in discussions or enrichment. So, which material in our program should we guarantee that the student will take with him? *____________________. And which do we present to the student, but not count on his learning? *____________________.
29) the material in frames (the specified objectives of the program); the discussion and enrichment material.	30. We promised we'd program this objective in frames. What is the difference between material presented in frames and discussions, in terms of what we expect the student to take away with him? *____
30) We try to insure that the student will learn every objective taught in frames. We cannot count on his remembering material from discussions.	That's the last frame. Go on to the discussion.

DISCUSSION: FOLLOWING CHAPTER FOURTEEN

Instructional Media

Should all instruction be presented in the form of written self-paced sequences of frames? Obviously not! "A picture is worth a thousand words." In many cases a picture, or a demonstration, is worth a great many frames. Here's an example. Gyroscopes, used for guidance and control purposes, have some operating characteristics which are quite complex. The spinning shaft of the gyro is mounted in a ring, which is itself mounted inside another ring. The interaction of movements of the pivoting shaft inside one ring, and that ring pivoting inside the outer ring is difficult for you to conceptualize unless you have seen it. Several programs, both commercial and military publications, have been produced which effectively teach the relationships involved. Unfortunately, even with an extensive use of drawings, the illustrations are limited to a two dimensional representation of a three dimensional interaction. Some students never successfully make the transition from two to three dimensions. A large number of frames is necessary to describe and explain the movements. A far more efficient process would involve the use of a model of a gyroscope mount, or even a two dimensional motion picture showing the sequence of movements.

A demonstration, or film, used as an integral part of the teaching sequence, could save a great many frames and a great deal of time. We should be concerned with accomplishing objectives, as noted earlier, by the most efficient means possible. This consideration is also relevant from the standpoint of instructional media and modes of presentation.

By media we mean the various forms in which instruction can be presented--printed matter,photographs and drawings, projected motion or still pictures, projected printed matter, tape recordings, live or filmed lectures and demonstrations, and so on. The most commonly used of these in almost all instructional situations are live lectures and conventional textbooks.

Although most programs are now printed, many are on tape or film. Almost any media can be used to present a program. The basic principles still apply. For example, you could determine the objectives of a demonstration, present the demonstration in small steps, and ask the student to respond to each step. His response could be to describe what was done or tell what will result, etc. And, of course, you would validate your demonstration-program by trying it out to make sure it accomplishes its objectives.

Or your program in book form can be supplemented, as in the gyroscope example, with films or demonstrations. Such additions to the program must be designed or selected to achieve specific objectives and should be validated with the written program. Ideally any media should be validated, but this is rarely done except by programmers. Few lectures, demonstrations, textbooks or films have ever been through an extensive tryout and revision process, in which the primary responsibility is assigned to the materials rather than to the student.

A change of presentation form also provides a welcome change of pace for the student, and some media have inherent attention-getting properties. Boredom is a name we use to refer to a reaction to a lack of stimulation change--a reaction that often includes a change of attention. When the student stops attending, the medium, be it lecture or program, stops working. Media should be selected primarily on the basis of the objectives: What form of presentation most effectively clarifies the content and enables the student to practice the relevant responses? But you should also consider selecting or varying media to produce and maintain student interest and attention.

Programming procedures for various media and for the multi-media approach are still undergoing research. We can expect these guidelines to hold, though: (1) objectives should be specifically stated, (2) media should be chosen on the basis of efficiency in achieving these objectives, with student interest value a second consideration, and (3) instruction, whatever the media, should always be validated.

Questions: (1) On what basis should you select various instructional media?

(2) List three guidelines for an instructional package, particularly a programmed or partly programmed package using various media.

Let's take a look at the instructional medium which concerns us most right now--the program. How could you combine a program with other media? Suppose you wanted to show slides after certain objectives were completed. If the program is self-pacing, and each student goes at his own rate, not all your students will be ready for the slides at the same time. Self-pacing is considered one of the great advantages of programmed instruction. It is, however, not an unmixed blessing, since problems of scheduling and administration can be difficult to handle. If you have 20 students, you would not be able to schedule your slides, lecture or demonstration 20 times, once for each student. Nor would you want to have all 20 attend a session if only a few had reached the part of the program for which that session was appropriate.

Some users of programs in training and education who find self-pacing more of a headache than an advantage, have turned to a modified or controlled self-pacing procedure. Controlled self-pacing refers to a procedure by which each student moves at his own pace through each unit or chapter in the program, but the units are scheduled and assigned so that the students progress through the program as a group. This kind of arrangement makes it convenient to schedule other media presentations and tests for the group, all of whom are at the same level of the program at the same time. Completion of the course isstill under the control of the instructor rather than dependent on each student's completion time. Another possibility, one that has been shown experimentally to have some advantage, is the use of lock-step presentation, in which all the students proceed from frame to frame at the same time. The frames are presented by some form of audio-visual device, such as TV, film projector or tape recorder. You might explore these possibilities, particularly the pre-scheduled use of printed programs, plus the incorporation of other instructional media.

The suggestion is not that you reject self-pacing. Use it whenever it is to your advantage and without serious administrative problems. Modify self-pacing wherever necessary to avoid difficulties. Make an instruction package, combining your program with any other media that will offer clarification, practice or interest value. Remember other media must be validated with the program. Incorporate anything you like in your instructional package. Just be sure it works!

Questions:

What is controlled or pre-scheduled self-pacing?

What is a lock-step presentation?

After you read the Narrative Review of Unit IV, try out and revise each of your three sequences a couple of times. You'll be surprised to find out how much the trial and revision process does change and improve your package.

Good luck!

POST-TEST CHAPTER FOURTEEN

1. What information should be published with the program for the benefit of the purchaser?

2. Name and describe the three types of adaptive sequencing.

3. How much do we guarantee the student will learn and remember of these parts of our program:

   (1) objective programmed in frames.

   (2) discussion material.

4. How should you choose instructional media to accompany a program (or for any purpose)?

5. What three guidelines can you follow in preparing an instructional package?

ANSWERS TO CHAPTER FOURTEEN POST-TEST

Question	Answers
1.	Frame 17
2.	Frames 19, 22 and 25
3.	Frame 30
4.	Discussion
5.	Discussion

NARRATIVE REVIEW OF UNIT I

(Chapter One) The instructional materials in this book make up a type of teaching machine, and the instructional content itself is called a "program". Instruction via a program is called "programmed instruction" and it has certain characteristics that are designed to make it easier for the student to learn. One of the characteristics is the guided practice of correct answers, since we tend to recall those things that we actively practice. For example, if you read the names of four of the States, and practice just one of the four, you will tend to remember only the one that you practiced.

Another characteristic is small steps. The material is broken down into small steps, since even difficult material is made much easier when it is broken down into small steps, each of which the student can handle. When the student responds correctly to a small step, using the assistance contained in that step, he is practicing the knowledge and learning it. The student needs a lot of help when he begins a topic, but as he learns more and more, he needs less and less help, so a program provides a lot of help early in a sequence, reducing the amount of help as the student learns.

But every material is made easy

A program also provides the student with immediate information as to the correctness or incorrectness of each answer he practiced. In this way the student always knows whether his answers are right or wrong. A program also lets each student proceed at his own rate of speed. The slow student will take much longer to use the program than a faster student, but each student will be able to complete the program and learn from it. Also, after the program is written, it undergoes a series of tests and revision, during which students use the program so we can see if the program teaches what it should, that is, if it accomplishes its objectives or goals.

This point is not true any more than it is for a textbook

Often we will add adaptive sequencing, which allows the program to adapt to each student, allowing each student to take the sequence or route that is best for him. A program that includes adaptive sequencing is much more flexible in meeting the needs of the entire range of student abilities. Branching, bypass, re-cycle are examples of adaptive sequencing techniques.

One last point, about objectives. A statement of objectives that we can use in writing a program must be stated in terms of what the student must do, rather than in vague terms such as, "know", "understand", "appreciate", etc. This concept should be important to every teacher or author, since it helps specify the content that must be taught.

(Chapter two) Every frame cotains a stimulus and a response. The information given to the student is the stimulus and his answer is the response. We want the student to learn an association, that is, produce a certain response whenever he see its stimulus.

If the response we want the student to learn is an unfamiliar new word, we must allow him to copy the word in a frame called a "copy frame". The copy frame is always followed by a "practice frame" in which the student must make the same response, but cannot copy it. This general rule for introducing unfamiliar new words, copy frame followed by practice frame, uses the "copy-practice" sequence design.

How is this determined?

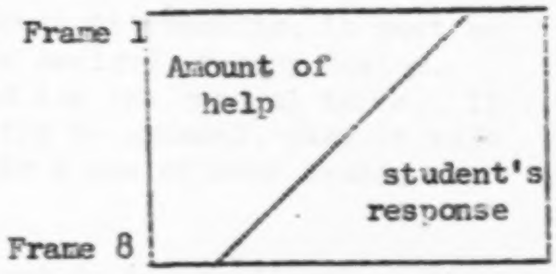
Similar to the copy-practice design is the "cue-practice design"--a "cue frame" followed by a practice frame. A cue frame is one which uses an existing association to cue a response. This is possible when the response word is already familiar to the student--part of his present vocabulary. In this example a language habit association is used to cue a familiar word, "upgrade":

> When we demote an employee and reduce his job level, we downgrade him. When we promote him to a higher level, we ____________________ him.

When the word is unfamiliar, or there is no convenient association, we rely on the copy-practice design.

Both cue and copy frames are "information frames"--frames which give information to the student, then make him use that information immediately. In doing so, the student forms a new association, which he must practice in the next frame. When we teach, whether in a program, lecture or textbook, we build new associations based on old associations.

A good program builds new associations by gradually reducing the amount of help given the student in each frame. By the end of the sequence the student should be able to give a complete answer with little or no help from the program. The frame that asks the student to produce a complete statement is called a "criterion frame". This diagram represents an eight frame sequence. It shows that the amount of help from the program decreases and the length and complexity of the student's response increases. The diagonal line indicates that it is a smooth sequence with steps that are neither too large nor too small.



(Chapter three) The stimulus that is part of every frame must be a specific or key stimulus, and the response must be relevant. A key stimulus is one to which you want to connect the response. It may be a word or term, or a concept. An adequate stimulus is never ambiguous. Here are some examples:

1)

The stimulus here is a concept:	The frannis bottle is tightly closed by a nird. To empty the frannis bottle you must first remove the ________________.

2)
Here the stimulus is a word(name):

George Washington was the first ________ of the United States. His home in Virginia was called *________________.

3)
And this stimulus is ambiguous:

George Washington was *________________
________________________________.

The relevant response to the adequate stimulus is the one you want the student to remember. "George Washington was the first president of the United ________" calls for an irrelevant response.

A programmer identifys the relevant responses by writing all of the criterion frames first. When the programmer sees what responses are necessary before the student can produce the criterion frame response, he can proceed to write frames that call for those responses. He must decide before he writes a frame, what response to call for in that frame.

The complete statements you require of the students in the criterion frame consist of both specific and general terms. Here we define a specific term as one for which there is no substitute but an exact synonym. A general term may be replaced by a number of words or terms that convey the same idea. For example, here is a criterion frame (the response is underlined):

> A Neon Tetra is a small fish that lives in the Amazon River.

The words "small", "fish", and "Amazon River" are specific. The other term, "lives in", is general (you could substitute "is found in", etc.)

If a word in a criterion frame response is specific, it must be taught using the cue design (cue-practice design) or copy design. The context of the criterion frame should cue the general terms. If you are not sure whether a term is specific or general, play it safe and assume it is specific--introduce it in a cue or copy frame, followed by a practice frame.

(Chapter four) While fairly broad in its application, the distinction between general and specific words,is vital to the programming of verbal concepts, principles and applications of these verbal concepts. In the following example two correct criterion frame answers are given. Notice that while the two sentences are quite different, they use the same specific words and describe the same process. While the general terms differ they express the same idea.

Criterion frame: What happens to the turbine in a jet engine and what does it do? *________________
________________________________.

Answer 1: The turbine is turned by the exploding or burning air and fuel gasses as they move through the turbine blades. The turning rotates the shaft that also has the compressor blades connected to it, so that they also turn, compressing more air.

Answer 2: As the burning gasses push against the turbine blades, the turbine revolves and so does the attached shaft and compressor blades, thus compressing more air.

There are still other ways to describe the relationships involved here. The point is that we want the student's responses to be flexible, not memorized. The rule is, the student must use the correct specific words, but express general terms in his own words. This flexibility--ability to provide answers in his own words--is part of what we call "demonstrating understanding". In this Unit you have met several rules similar to the one above. Here is a summary of the five rules you have seen. These rules are to be recorded on page 8 of the APPENDIX.

Rule One: An unfamiliar new word is introduced in a copy frame followed by a practice frame.

Rule Two: If there is an existing association,use a cue frame followed by a practice frame.

Rule Three: The student's response to a criterion frame should contain all the correct specific words, but general terms should be expressed in his own words.

Rule Four: Every specific word in a criterion frame must have been introduced in an information frame, such as a cue or copy frame. We usually assume that in a criterion frame the general terms will be cued by the context of the frame.

Rule Five: Every information frame must be followed by a practice frame calling for the same response.

Although usually we want the student to learn to respond in his own words, there are objectives that require memorization, that is, when every word is a specific word. For example, we may require the student to be able to name the eleven Confederate State of America. You could, of course, just hand the student the list of the states and tell him to memorize them. The advantages of a programmed sequence are that he learns more easily because of the controlled small step presentation, and remembers better because of the controlled practice. A program controls the stimulus presentation in order to provide careful guidance of the student's responses.

NARRATIVE REVIEW OF UNIT II

(Chapter Five) Every specific word must be introduced in an information frame. Many beginning programmers make the mistake of calling for a response that has only been mentioned in the previous frame, but never cued or copied. For example:

(Frame 1) The four strokes in a gasoline engine are, in order: intake, compression, power and exhaust. The first stroke is the __________ stroke.
(Frame 2) The first stroke is the ___________ stroke. The second is the _______________ stroke.

In the first frame of that two frame sequence the word "intake" was practiced as a response to the stimulus "first stroke". We can expect, then, that the student will respond "intake" to the stimulus "first stroke" in frame 2, the practice frame for that response. But we cannot expect him to respond "compression" to the stimulus "second stroke" because that association has not been established. Although he might remember all that he read in the previous frame, we cannot rely on it. If we believed that a student remembered everything he read, we wouldn't need programs! We assume that an association is established only when we provide systematically for a response to occur in the program.

Perhaps using a cue or copy frame to introduce every specific term seems like a tedious process, but it is important that the student make as few errors as possible. Every time he makes a mistake he is practicing that wrong answer.

Here is an example of a short sequence that uses cue and copy frames to introduce every specific word.

	1. Alpha Romeo, like Ford, Chevrolet or Plymouth, is the name of a ____________.
1) car.	2. An Alpha Romeo is a kind of _______.
2) car.	3. A small powerful car, such as an MG, a Porsche or an Alpha Romeo, is called a sportscar. An Alpha Romeo is a fast, small and very well-built ______________.
3) sportscar.	4. An Alpha Romeo, like a Porsche or Triumph, is a foreign-built, small, powerful _________________________.
4) sportscar.	5. An Alpha Romeo is a _______________ built in the country in which the Leaning Tower and the Vatican are located. Alpha Romeos are manufactured in ____________.

5) sportscar; Italy.	6. An Alpha Romeo is a ________________ made in ________________.
6) sportscar, Italy.	7. An Alpha Romeo is *________________ ______________________________________.
7) a sportscar built in Italy (Italian sportscar, or an equivalent response).	

Notice in the sample sequence that the responses "car" and "Italy" are introduced in cue frames, the response "sportscar" is introduced in a copy frame, and all of these information frames are followed by practice frames. Notice also that frame 5 above is both a practice frame for the response "sportscar" and a cue frame for the response "Italy". Such a frame that combines the elements of a practice frame for an old response and an information frame for a new one is called a "combination frame".

Here is another mistake common to beginning programmers:

> An Alpha Romeo is a sportscar. Yes, an Alpha Romeo is a ______________________.

It is too simple, too dull, and doesn't require the student to read the frame in order to see, from the sentence structure, what response is desired.

(Chapter Six) Of course you could just tell the student that an Alpha Romeo is an Italian sportscar in a fraction of the time it would take him to finish the seven frame sequence above. But hearing or reading something is not always the same as learning it. To be sure that the student learns, a program insists that he make active responses to each bit of information. And unless the student has made an active response to a stimulus, we don't believe he has learned it.

Nor do we believe that the student who has learned a response to a certain stimulus can produce that stimulus in the presence of the response. For example, if the student has learned the response "Samuel Clemens" to the stimulus "Mark Twain was the pen name of _________ _________", we don't expect him to respond correctly to "Samuel Clemens' pen name was _____________ _____________". Before we could trust the student to produce each of these two responses in the presence of the other, we would have to teach it as a "two-way S-R connection". A two-way S-R connection is one in which each element is a response to the other element and a stimulus to it. That is, it has been taught both ways. The student will respond "Mark Twain" to "Samuel Clemens pen name" and "Samuel Clemens" to "Mark Twain was the pen name of". Teaching an association one way does not guarantee that the student will learn it in the other direction.

You learned before that the first thing a programmer does when preparing to write a program is state his objectives in broad terms, then write the criterion frames as a way to outline his objectives more precisely. Later he writes his first draft of the frames. The next step is to put the first draft aside for a day or two, so that the programmer will have a fresh outlook on his frames as he goes on to edit them, try them out on one student, revise, and continue trying them out and revising until the program accomplishes its objectives.

(Chapter Seven) Here is an outline of the procedure for writing cue and copy frames (see APPENDIX page 11): ask yourself if the response is a part of the student's repertoire already. If the answer is "yes", you will start to write a cue frame. If the answer is "no", you'll write a copy frame. If you don't know whether the response is part of the student's vocabulary, or have any doubt, hopefully you can test the student to find out. If there is no way to test the student, and you are not sure the response is familiar to the student, assume he does not know the word and write a copy frame. It is better to underestimate the student than over-estimate him.

If you are sure the response is already a part of the student's repertoire, you try to think of an existing association for that response and write a cue frame. There may be no convenient existing association, in which case you will write a copy frame. Usually a cue frame is preferred to a copy frame, but if your attempts to cue the response result in a dubious frame, you can resort to the copy frame.

There should be two components to a copy frame. The first component is the key stimulus plus the relevant response. The second component is a related (but not identical) key stimulus, plus the blank. If the two stimuli are identical or too similar, the frame is dull and requires no thought. For the same reasons we never capitalize or underline the word to be copied in a copy frame. We must bury the response in context so the student has to think about his answer. You see in the diagram that after you check to be sure the student must think about his response, and make sure all the necessary components are present, you may use the frame in the sequence.

The diagram, or flow chart, is designed to be used as an external mediator, or "go-between", to help you write information frames. After you learn to follow these principles automatically, the chart will become an internal mediator.

Another example of an external mediator is a dictionary. A mediator is any outside source that helps you give the correct response--a book, table of figures, map, etc. An example of an internal mediator is the multiplication tables you learned as a child. It helps you respond to multiplication problems, such as 643 X 84.

(Chapter Eight) Most copy frames consist of two sentences. The first contains the key stimulus, plus response to be copied, and the second contains the stimulus plus blank. The "meat" or context of the frame may be either general statements or clarifying examples. These may also be referred to as rules and examples. A method of designing frames in terms of rules and examples has been developed, called the RULEG system. From the point of view of a RULEG description, the two sentences, or components, of a copy frame can be rule + example, example + rule, rule + rule, or example + example. The blank is always in the second component. It should be long enough for the response, but not exactly the same number of spaces as there are letters in the word. Here is an example of a copy frame:

First component: (stimulus + response)	The prefix "bi" means two.
Second component: (stimulus + blank)	A BIcycle has ________wheels, and a BInary number system uses only ___________numbers.

In the example above, the first sentence was a rule and the second consisted of examples. The practice frame that follows a cue or copy frame need consist of only one sentence, stimulus + blank, calling for the same response as the preceding information frame. A combination frame must contain all the necessary components of a practice frame and cue or copy frame. Naturally you should vary the stimulus and occasionally include interesting sidelights.

The first thing you decide before writing any kind of frame is the response. A cue frame uses an existing association to teach a new association. There are many types of existing associations. Here are some examples:

Classification (stimulus listed with others of its class, response is classification of stimulus)	Tuna, trout, bass and Neon Tetras are all __________________. A Neon Tetra is a kind of _____________.
Opposite Meanings	In a program we always want the learner to be right. We want him to practice the ____________ answers, and we never want him to *_________________________________ _________________________________ _________________________________ _________________________________ _________________________________.

Obvious Conclusion	A student should never be in doubt about the correctness of his answer, so each frame of the program immediately tells the student whether he was ____________ or ______________.
Related Terms	We call this book a teaching machine. You are going to ______________ several things from this teaching machine.

NARRATIVE REVIEW OF UNIT III

(Chapter Nine) The first thing a programmer must do, as he begins to write a program, is prepare his objectives. First you must write a broad statement of the objectives expressed in behavioral terms, that is, in terms of observable behavior of the student.

Next you must specify every precise objective. A practical way to do this is to write the criterion test questions and answers. The answers to the criterion test contain every response the student must be able to make when he finishes the program. This is a way to outline all of the students responses--the same responses that will be required by the criterion frames of your program.

A criterion test is different from an achievement test. The criterion test measures every objective--every response the student must be able to make--while an achievement test only samples the objectives. The criterion test is designed to measure how well the program taught, while the achievement test tests the student. Given a cooperative student, the program is responsible for teaching him the objectives.

The objectives of a program fall generally into three catagories, classified according to the type of responses required of the students. Frames and criterion test questions may also be labeled according to their response objective. A discrimination objective (or frame, or test question) requires the student to choose the correct answer from a limited number of possible answers. The answers may or may not be listed in the frame. There must also be something unique or specific about the stimulus in a discrimination question. For example, if the question were, "What make of car is that?", there would be several specific components of the stimulus (the car) that made it different from any other make, and the possible responses would be limited to brands of cars.

The second type of objective, constructed verbal response, is a written or spoken response in which the student must produce or construct his answer in the form of a sentence or short answer, defining terms or relationships. Here is an example of a constructed verbal response frame:

A constructed verbal response is *______________________________ ____.

The answer to the frame is, of course, the definition above.

The third response classification is the performance response. Usually performance questions ask for non-verbal manipulative responses, but unguided "real life" verbal performances may be included in this catagory. Generally, then, we think of such things as turning knobs, skiing, wiring circuits, etc. as performance responses. We might include making a speech or writing a program when it is a highly complex, unguided response.

It is not as important to label your objectives correctly, as it is to be sure the student practices the response in the same form he will need to know it when he finishes the program. For example, if the student must be able to write objectives, be sure he practices writing objectives.

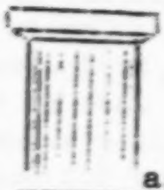
You can see, though, that some discrimination frames would have a place in the teaching of writing objectives. A performance objective, (as we might label writing objectives), might contain several discrimination or constructed verbal response frames or sequences. These may be required in the final behavior of the student, or they may only support, or help teach, the ultimate objective. In the latter case, we would call them supporting responses.

(Chapter Ten) Because it involves a limited number of choices, the discrimination objective is easiest to teach. A constructed verbal response is a little more difficult to teach, and the performance response is the most difficult. If you have any doubt about whether a student should learn a response as, for example, a constructed verbal response (CVR) or discrimination (DISC), choose the more difficult catagory (CVR, in this case). By the same token, if you have trouble deciding whether the student must learn an objective as a constructed verbal response or verbal performance, play it safe and choose performance. For example, if you're deciding whether the student need only be able to define laissez faire economic policies, or must be able to write a lengthy report on the subject, teach him to write the report.

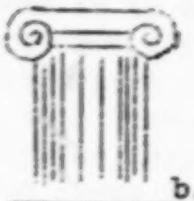
While a performance task is generally taught almost entirely with performance frames, the verbal performance sequence would probably consist of many CVR frames plus a few DISC and verbal PERF frames. A CVR sequence is made up mostly of CVR frames,with a few DISC's. The DISC sequence is almost all DISC frames.

A DISC sequence usually begins with an immediate application information frame. As the name implies, in such a frame the student is presented a new bit of information and must use it immediately. Here's an example of an immediate application frame:

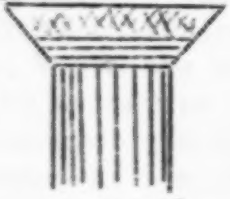
An ionic column has a small roll, or scroll, at the top. Which of these is the top of an ionic column?



_______a.



_______b.



_______c.

This type of information frame requires the student to either perform a mathematical operation or answer a multiple choice question. The DISC practice frame that follows calls for the same response using other examples

Among the types of multiple choice questions you could use in a DISC sequence is the very simple "yes or no" choice:

Is "boat" a noun? __________(yes or no)

Another, more difficult, multiple choice question is the "abc" type:

Which of these is a noun?

_____a. think _____b. of _____c. Boston

A discrimination frame in which the choices are not listed in the frame is possible when the set of possibilities from which he should choose is obvious to the student.

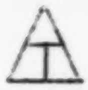
(Chapter Eleven) Each frame of a performance sequence requires the student to perform one small step of the task. The student's responses are confirmed either by showing him a picture of the correct response or telling him what should have happened as a result of his response. After the student has completed the task once, carefully guided by the program, he must repeat the performance, this time with less help. The student continues to repeat the task, with less help each time, until he can do it alone.

The remainder of this unit deals with the preparation of objectives for frame writing. This very important process consists of five steps.

Step one is the broad statement of the program's objectives. As you learned earlier, the objectives are always stated in behavioral terms--in terms of what the student must do.

Step two is the preparation of the criterion test questions and answers. The criterion test covers every objective of the program.. The list of criterion questions will be very similar to a list of the criterion frames. Both step two and step three, the narrative explanation, will be further discussed in Chapter twelve.

Step four is the preparation of a table listing all the stimulus-response pairs you will teach in your program. To construct the S-R table, divide your page in half vertically. Label the left side "stimulus", the right, "response". In the response column of the S-R table, write all of the responses the student is to make to the first criterion frame. In the stimulus column, across from these responses, write the criterion frame. Next, list again the first response to the criterion frame. Decide to what stimulus you will "connect" that response, and list it in the stimulus column across from the response. For example, the first response called for by the criterion frame in the sequence teaching the use of a multiplication-division pyramid, is to draw the pyramid.

STIMULUS	RESPONSE
Draw an M-D pyramid	

Continue to list the remaining responses to the criterion frame, and the stimuli to these responses. Responses that are not required by the criterion frame, but which help to teach the necessary responses, are called supporting responses. For example:

STIMULUS	RESPONSE
Bi-metal strip is composed of	two different metals
(supporting	response)
Prefix BI means	two

After you have listed the responses the student will learn before he answers the criterion frame, repeat the process for each criterion frame in your program.

Step five is to rearrange the S-R pairs written in step four to represent the teaching sequence. You can specify the teaching sequence by writing a second, modified, S-R table. It is easier to merely outline the teaching order of S-R pairs, or renumber those in the original table to indicate teaching order.

(Chapter Twelve) Here is an example of a broad statement of objectives, such as those written as the first step in preparing objectives for programming.

> " Student must be able to draw the M-D pyramid, put multiplication and division examples into it, and then use the pyramid as a guide to write all possible equations represented by the letters in the pyramid."

Notice that the statement avoids such vague terms as "student will understand", or "grasp the principle". Instead, the objectives are stated in terms of observable behavior of the student.

The items written for the criterion test, step two, are generally questions or instructions, rather than incomplete sentences. Information and practice frames are most efficiently written in the form of incomplete statements. Criterion frames may be either incomplete sentences or questions or instructions. The criterion test questions should require the same type of response taught in the sequence, that is, if the student learned a constructed verbal response in the sequence, the test question for that objective should require a CVR. The criterion test must test every objective, so that a mistake by the student will pinpoint the portion of the program that failed to teach adequately. The purpose of the criterion test is to measure the performance of the program rather than the student.

The third step in the preparation of objectives is to write a narrative explanation. You may use a good textbook or other source material to write the narrative, covering all the objectives of your program in textbook form.

The S-R table written as step four reflects the order in which the student performs the required responses, not the order in which they are taught. Step five, then, is to rearrange the S-R pairs in the table to represent the teaching sequence. Regardless of how you do this, whether you rewrite or only renumber, your object is to build new responses onto the student's current repertoire in easy steps. This means the teaching order should be generally from the least to the most complex objectives.

These five documents should help you write your frames, not restrict your work. If at any time you think you can improve your preparatory steps, do so.

NARRATIVE REVIEW OF UNIT IV

(Chapter Thirteen) There are several types of discrimination questions that may be used in a DISC frame. Here are some examples:

Two answers, both given.	Sample X is ___________________(larger, smaller?) than Sample Y.
Two or more answers, not given.	What type of frame is frame 12? *____.
"abc" multiple choice.	A Mexican peso is worth in American money about (check one) ___a)$2.40;___b)$.08;___c)$.80;___d)$1.40
Double true-false or "Either, neither, both".	A program consists of (choose one) ___a. small steps; ___b. trial and error; ___c. both; ___d. neither.

In any sequence the student should make progressively more difficult responses. In the case of a DISC sequence, this means that toward the end of the sequence, the student must make finer discriminations--choose among answers that are more alike.

The rest of Unit Iv deals with the edit, try out and revision processes, following the guides in the APPENDIX, pages 15 - 20.

It is wise to set your completed frames aside for a while before beginning to edit. Start the editing process with a re-evaluation of the objectives, checking whether they are behaviorally defined. The objectives must also be technically correct and appropriate. You may submit yours to a subject matter expert for his approval. After you check your criterion test and narrative, to be sure they cover every objective, you may have them checked by a subject matter expert too.

Next, when your objectives are found satisfactory, or revised, you systematically investigate your sequence to see if it teaches those objectives. Begin by reading the responses alone, in groups of 25-50. The criterion frames should require the same performance described in the objectives. The frames leading up to each criterion frame should prepare the student to respond correctly to the criterion frame. If the frames do appear to build up the student's capability to master the objectives, go on to edit them for clarity.

Read the frames to see if they make sense. You are more likely to catch ambiguities and gaps if you haven't looked at your sequence for a few days. The sequence should be both clear and interesting. If you find difficulties, you may have to make major revisions, involving more than one or two frames. After major revisions, check again to be sure the program still teaches the objectives, reading the responses in groups of 25-50 as you did before.

If the revisions only involve one or two frames, go on to check whether the sequence follows the major programming rules. Be sure each new specific word is introduced in a cue or copy frame and each principle is clarified by a number of examples. Check also whether the steps appear to be small enough, yet make adequate progress.

After the program has been edited, it is ready to try out on a student from the target population.

A practical way to prepare the "test package" or program to be tried, is to type each frame on a 3" X 5" file card, with the answer on the back of the card. This way frames can be changed, added or removed easily.

You should also prepare a few frames for the student to practice using a program.

If your program is longer than 60 or 70 frames, divide it into separate test packages of about that number. Each test package should be a meaningful unit, ending with a criterion frame.

Your first tryout student should represent the top of your test population. In a quiet room, without distractions, give the student the practice frames, then the test package, one card at a time. Have him read the card silently, then aloud, filling in the blanks. Do not tell him whether he is right or wrong. After he reads the card, he should read the answer on the back. If he answers incorrectly, help him get the right answer. Take notes during the entire process, recording all difficulties. Write down anything you say to help him with the answers. Apparently that information should be in the program. Try to find out the cause of every error. After he has finished the test package, give the student the criterion test orally. Ask any other questions that might be necessary, if you're still not sure how well he's mastered the objectives. Ask him for comments and criticisms. Take volumes of notes. The key point is get as much information from the tryout student as you can.

After each tryout student, you will revise the sequence, attempting to eliminate the problems found by the student. You will probably test the program on five or six students, one at a time. Each one should rank lower in the target population. The last tryout student should represent the very poorest, slowest learners in the population for which the program was written.

Part of the revision process is the addition of review frames. If a student answers a criterion frame correctly, but later misses the very similar test item, he has probably been allowed to forget the answer. In that case we need to add review frames between the criterion frame and the test. Generally review frames are inserted after progressively longer intervening sequences. Review frames may appear with some sensible transition, in or between sequences dealing with other objectives. A later frame teaching a related objective may include review material. Narrative reviews, although not thoroughly researched, may be used to take the place of some of the many review frames required in a long program.

(Chapter Fourteen)   The information supplied by the tryout student is used to revise the program. Begin by scoring the criterion test. Consider any doubtful answer a wrong answer. For each criterion question he missed, check in your notes to see if he missed the corresponding criterion frame.

If the student answered the criterion frame correctly, but missed the test question, he may have forgotten the objective. Insert review frames.

If the student missed both the criterion frame and test question, the sequence needs revision. Your notes may help you find and eliminate the reason for the errors. A frame may be vague. Don't change the criterion frame unless it is ambiguous. Making the criterion frame easier won't help teach the objective. The student may need only another example or a little more practice. Don't add more than one or two practice frames for an objective. If that's not enough, your next student will let you know.

After you have revised the sequences leading up to the missed criterion frames, find the other frames the student missed. Your notes should have this information. Before rewriting a frame, decide whether that frame was at fault, or the sequence leading up to it. Be careful not to "fix" a frame by overcuing. Eventually the student must be put on his own.

Continue the individual tryouts until the student makes few errors on either the test package or the criterion test.

The next step is to test the entire program on a group of 5-10 students who represent the range of the target population. The group situation is less artificial than the individual tryouts. Use the same revision until the students have little difficulty with program or test.

The group tryouts may be followed by a field test. In a field test the program is used by a large group of the target population in the actual learning situation for which the program was developed.

This test-and-revise process goes on until the program achieves its objectives. The criterion many programmers use to determine at what point the program works is the "90-90" criterion. The program is considered successful when 90% of the students learn 90% of the material, as measured by the criterion tests.

Because the buyer, or user, of a program is very concerned with the results of field tests and tryouts, such information should be published with the program. The information for the user should include the broad statement of the program's objectives, a complete description of the target population for which the program was designed, and the results of the tryouts or field test. The field test or tryout data should contain a description of the test students, their range of abilities and test scores, and by what criteria the program achieved its objectives--how many students learned what per cent of the objectives.

You may find, after the program has been tested and revised several times, that part of your target population needs more or less practice and review than the rest. An alternative to the addition of many review frames for the benefit of few students is to use one of the three types of adaptive sequencing. (1) A "washback" sequence requires the student who misses the criterion frame to repeat the sequence. (2) A "bypass" sequence allows the student who answers a test frame correctly to skip material he doesn't need, while those who answer incorrectly continue forward, frame by frame. (3) The student who chooses one of the several incorrect answers in the multiple-choice "branching" sequence test frame is sent backward or forward in the sequence to a frame, or frames, that correct his particular error. If he chooses the correct answer to the test frame, he goes on to the next objective.

It is not necessary to eliminate everything from the program that is not a specific objective. Material which is related to the objectives, but not part of them, may be included for enrichment, or interest value. You can add interesting sidelights in a frame that requires no response, or take time out from the programmed sequence for a narrative discussion. You may insure that the student pay attention to such enrichment by asking a question about it. But never count on his retention of material that is not taught step by step in frame sequences.